AURORA ®

Outdoor Photovoltaic Inverters

USER MANUAL
INSTALLATION and MAINTENANCE

Models*: PVI-NEMA3R-250-US
PVI-NEMA3R-300-US
PVI-NEMA3R-350-US-TL **
PVI-NEMA3R-400-US-TL **

(*) “US” indicates the country in which the product is for sale.
(*) “TL” indicates the absence of the isolation Transformer on board.
(**) versions not available

Rev. 1x

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for models indicated in front of Report that shall be followed during installation and maintenance of the inverter.

LEGEND

Marks paragraph references containing important safety information and warnings which must always be respected.

Indicates the current paragraph is continued on next page.

Indicates the end of a paragraph

Symbols of this type refer to warnings in the same paragraph or otherwise to the page indicated. They contain information on personal safety and tips on how to reduce the risk of accidents and injuries.

Refers to a warning on possible damage contained in the same paragraph or on the page indicated.

Texts marked with this symbol contain indications concerning environmental protection.

Texts marked with this symbol contain additional information and insights.

Paragraphs marked with this symbol indicate the necessity of using adequate protection prior to hazardous operations (e.g. use of insulating gloves for work with voltages up to 1000 VDC, use of goggles, etc.).

DANGER

Texts marked with this symbol indicate provisions which, if not met, could result in death or serious injury to the person or persons involved.

WARNING

Texts marked with this symbol indicate provisions which, if not met, could result in slight or serious injury to the person or persons involved.

NOTICE

Texts marked with this symbol indicate provisions, which, if not met, could result in potential damage or malfunction of the device and things in general.

THANK YOU FOR YOUR TRUST

The "AURORA" Power-One Inverter you have purchased is a device containing the latest technologies. Before using this device for the first time, read these user instructions in order to fully and quickly learn the commands and functions, as well as the potential dangers for you and for others, and how to avoid them.

For further information about the device or in case of failure to provide part of the documentation that makes up the manual, contact “CUSTOMER SERVICE” available on website Power-one (www.power-one.com).

Questions, criticisms and suggestions are always welcome.

REVISION TABLE

Revision Document	Author	Date	Approved by	Description of Modification
0.0	A. Morucci S. Soldani	02-11-09	D.Nocentini	-
1.0	A. Morucci S. Soldani	06-05-10	D.Nocentini	First Issue For New Design
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1. HOW TO USE THIS MANUAL

The product covered by this manual must be used solely for the purpose described herein. Any other usage is considered improper and dangerous, and Power-One declines any liability for damage to property or personal injuries due to inappropriate use and/or other use than the intended one.

Chapter §4

Before replacing any components in an Aurora inverter as covered by this manual, and as may be described and mentioned in this manual, particularly with regard to dischargers and fuses, always contact the dealer. Power-One will not accept any liability for damages or injury due to the use of unapproved spare parts.

Power-One reserves the right to make changes to this Manual and to the product without prior notice: the latest version of the Manual indicating the revision number will be available soon on the site (www.power-one.com).

The figures are for approximate information and some details may not exactly correspond to the product referred to in this manual. If any questions arise regarding the suitability of any information provided, contact Power-One.

This manual describes all equipment and models. Some models and versions are not marked as such. It is therefore possible that the product you have may not be provisioned with certain equipment.

This Manual contains important safety and operation instructions that must be understood and accurately followed during the installation and maintenance of the product.

1.1. Disposal of waste

As a manufacturer of the electrical device described in this Manual and in compliance with Italian Legislative Decree No. 151 of 25 July 2005, Power One informs the customer that this product, when scrapped, must be delivered to an authorized collection point.

1.2. Symbols used with the product

The symbols referring to the electrical parts on the inverter are also be used in this manual and are as follows:

⏚	Connection point for earth conductor
+	Continuous positive voltage pole
-	Continuous negative voltage pole
⎓	Direct current (VDC)
⏚	Earthing (GRD)

1.3. Labels used with the product

Refer to Fig 1-1 and 1-2.Make sure to read and fully understand the label information before installing the product. The inverter is provided with several labels, some of them with yellow background related to safety devices.

Figure 1-1: UL mark and Caution and Danger labels

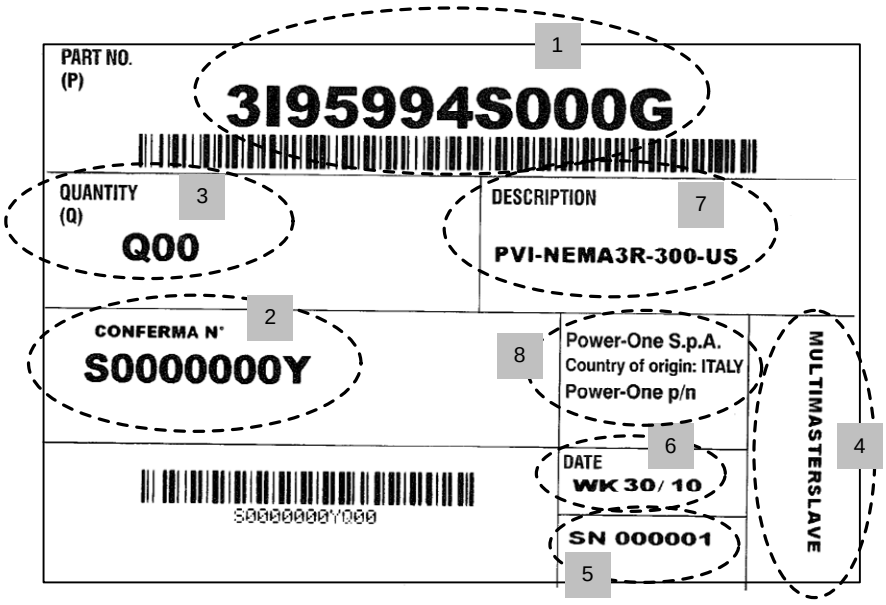


Figure 1-2: Identification label

The items on the ID label of Figure 1-2 are as follows:

- Generic code “Part Number”
- Serial order
- Serial order total quantity
- Shipping configuration
- Serial Number
- Production date
- General description of the product
- Country and Factory of origin.

1.4. Documents provided with the device

- This manual
- Test Certificate
- CD

2. IMPORTANT SAFETY INFORMATION

NOTICE

The installation of the inverter products described in this manual must be performed in compliance with prevailing codes and local regulations.
It is strongly recommended that all instructions in this manual be read and understood prior to commencing installation and use of the product.

NOTICE

For any maintenance or repairs (not covered in this manual), please contact the dealer. Unauthorized changes may damage the device and may result in the loss of product warranty.

NOTICE

Electrical connections must always be made correctly with particular attention to maintaining correct polarity in order to avoid possible damage to the device and the photovoltaic panels.

WARNING

The connection to the distribution grid must be made only after receiving approval from the responsible authority having jurisdiction for electricity distribution, as required by prevailing regulations in force within the installation locality, and must be completed by only qualified personnel.

We recommend using appropriate

WARNING

In case of failure, an electric arc may be produced within the PVI-NEMA3R-XXX-US(-TL), supported by the DC source. At worst, this condition could cause fire and smoke damage to the equipment and surrounding area and thus being a danger to personnel and property.
Carefully follow all instructions in this manual, paying particular attention to the sections describing installation procedure.

Chapter §10

DANGER

Any personnel working on items internal to the inverter or removing protections from live parts must wear suitable personal protection equipment. The inverter is connected to high voltages associated with the photovoltaic field and to the distribution grid, and is therefore always energized with hazardous voltage. Do not remove the panels and/or any other protection, unless authorized by the plant manager. Removal of these protections exposes personnel to possible electric shock hazards.

We recommend using appropriate tools

DANGER

During installation and/or maintenance procedures, it is extremely important to be able to easily isolate the inverter prior to its connection to the PV field by means of the DC switch within the device as there may be voltages and energy levels that can result in serious fire and shock hazards. This can be done most effectively with an externally mounted disconnect switch, and strings may be disconnected by means of the AURORA PVI-STRINGCOMB-US string combiner (if present).

We recommend using appropriate tools

2.1. General Information

NOTICE

Inappropriate use and/or improper installation can cause serious damage to personnel and/or property.
To prevent accidents and unnecessary hazards, all operations concerning transport, installation and switch on, including maintenance, must be carried out by qualified and trained personnel, possessing the skills needed to perform required tasks as necessary to meet requirements of any applicable standards and regulations

WARNING

It is the responsibility of the installer to complete all tests and measures to ensure the adequacy of the final plant operation, in accordance with the prevailing codes and applicable regulations in force.
Failure to comply will result in suspension of any form of warranty and liability by Power-One.
If any questions that arise during reading of this manual or during subsequent installation, it is the responsibility of the installing party to clarify any issues before proceeding by contacting P1 Technical Services.
Records of the tests performed during installation must be available for subsequent inspections and for purposes intended by the standards and laws in force.
Power-One assumes no liability for damage to property or injury to personnel due to incorrect interpretation of the instructions in this manual and/or from improper use of the device.

3. GENERAL INFORMATION AND FEATURES OF A PHOTOVOLTAIC SYSTEM

The purpose of this chapter is to provide the user of "AURORA PVI-NEMA3R-XXX-US(-TL)" general information concerning the photovoltaic systems that transform solar energy into electrical energy, usable in the distribution grid.

3.1. Photovoltaic energy

In the process of energy conversion, for many years, industrial companies (great energy consumers) have been experimenting with forms of energy saving and lower emission of pollutants, through a prudent and rational use of known resources and the research of new forms of clean and inexhaustible energy.
Renewable energy sources provide a major contribution to solving the problem. In this context, the exploitation of solar energy to generate electricity (photovoltaic) is becoming increasingly important worldwide.
Photovoltaic energy represents an enormous advantage in terms of environmental protection because the solar radiation we receive from the sun is directly converted into electricity without any combustion process and without the production of nature-polluting waste.
Photovoltaic panels convert the energy radiated by the sun into electrical energy of "DC" type (by means of a photovoltaic field, also called a PV generator). In order to supply the distribution grid so this electricity can be used, it should be converted into alternating current "AC". This conversion, known as DC to AC conversion, is carried out efficiently by the AURORA inverters without the use of rotating elements, but only by means of static electronic devices.
When used in parallel with the grid, the alternating current output from the inverter flows directly through the isolation transformer (where required) into the industrial distribution circuit, connected in turn to the public distribution grid.
If the supply from the photovoltaic field is low, the amount of energy necessary to guarantee the normal operation of the connected appliances is taken from the public distribution grid. However, if the opposite occurs, i.e. a surplus of energy is produced, it is directly introduced in the grid, thus becoming available for other users.

In compliance with prevailing local codes and regulations in force, the energy produced can be sold to the distribution grid or credited against future consumption, thus producing energy savings.

3.2. Fundamental elements of the photovoltaic field: "Strings" and "Arrays"

In order to significantly reduce installation costs of the photovoltaic field, especially related to the wiring problem on the inverter DC side and the subsequent distribution on the AC side, the STRING technology was developed:
A photovoltaic PANEL is made up of many photovoltaic cells mounted on the same support base.
A STRING is made up of a certain number of panels connected in series.
An ARRAY is made up of one or more strings connected in parallel.

Large photovoltaic systems may be made up of several arrays, connected to one or more AURORA inverters.

By maximizing the number of panels in each string, the cost and complexity of the connection systems of the plant may be reduced.

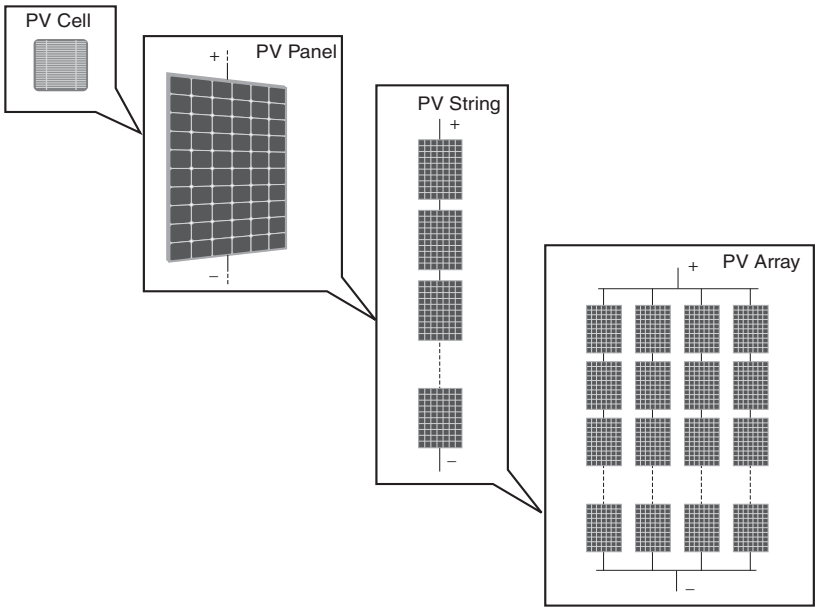


Figure 3-1: Array Composition

NOTICE

In no case should the voltage of the string exceed the maximum permissible voltage, in order to avoid damage to the device.

Chapter §0

The DC current value of each connected "array" must also be within the limit values of the inverter located downstream.
Decisions on the exact structure of a given photovoltaic system depend on a number of factors and considerations to be made, such as the type of panels, the available space, the future location of the system, long-term energy production targets, etc.
Visit the Power-One website (www.power-one.com) to access an available configuration tool that can help with the correct sizing of the photovoltaic system.

4. SCOPE AND GENERAL DESCRIPTION OF THE PRODUCT

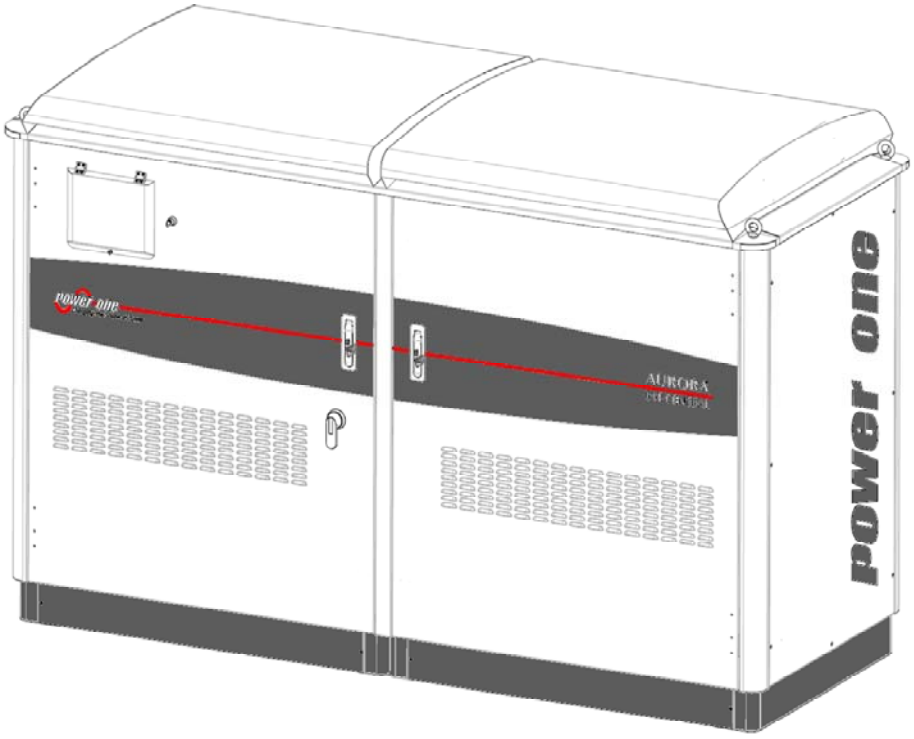


Figure 4-1: PVI-NEMA3R-XXX-US (-TL) Series

The family of PVI-NEMA3R-XXX-US(-TL) inverters (Figure 4-1) are devices designed exclusively for converting solar energy into electrical energy that is compatible with the grid of the country where it is marketed, and they are equipped with adequate electrical and mechanical protection.

If the inverter's communications link is connected to Aurora string combiner boxes (AURORA PVI-STRINGCOMB-US), it will allow monitoring of the entire photovoltaic field, including the following information:

- Reading the string currents (10 channels available)
- Reading the total voltage of the field
- Check proper functioning of the internal fuses, to protect the photovoltaic panels.
- Ability to read other information (temperature and irradiance) using optional sensors.

The AURORA PVI-NEMA3R-XXX-US(-TL) inverters can feed the connected electrical grid with energy from the photovoltaic panels.

Chapter §3

When connected to the grid, alternating current from the inverter output flows in the local distribution circuit, and in turn to the public distribution grid (Figure 4-2 and Figure 4-3).

For connection to medium voltage (MV) electrical grid described in Figure 4-3, models marked as "TL", are not provisioned with an internal isolation transformer and must have a "dedicated" external transformer (MV/LV type), specified to match the electrical features of the inverter model used.
The specification and installation of the mandatory external transformer is the responsibility of the customer. Instructions for the dimensioning of the external Transformer are indicated below.

- MV side (medium voltage): reference to grid features.
- LV side (low voltage): reference to output electrical characteristics of a PVI-NEMA3R-XXX-US(-TL) inverter.

Chapter §0

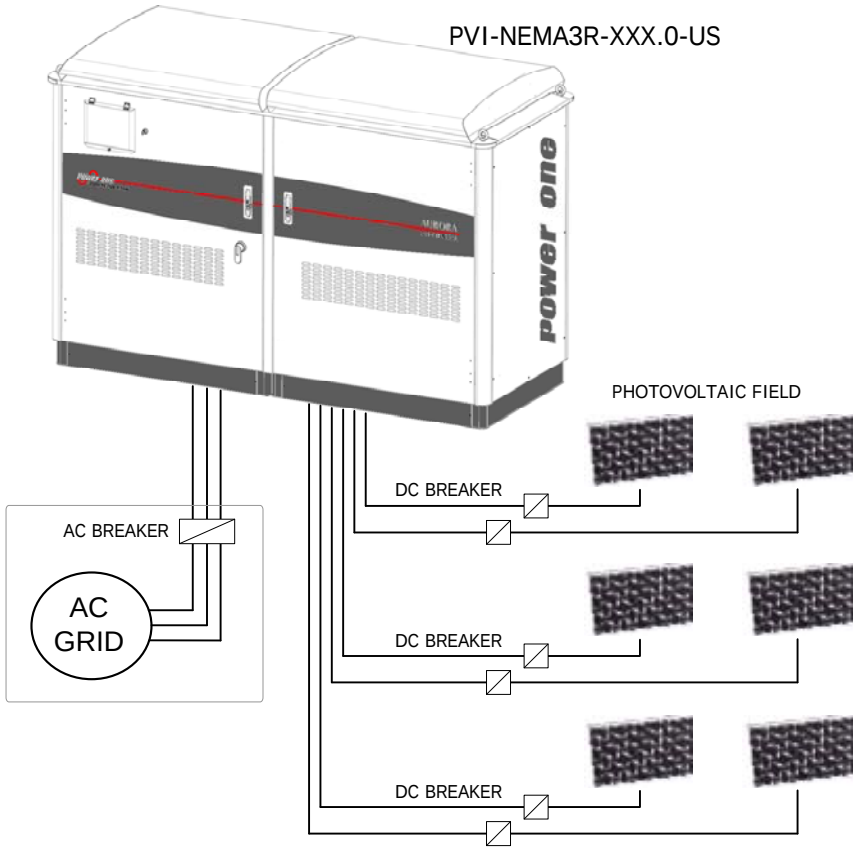


Figure 4-2: Connection Details for inverter models (250KW/300KW) provisioned with internal isolation transformer to AC grid

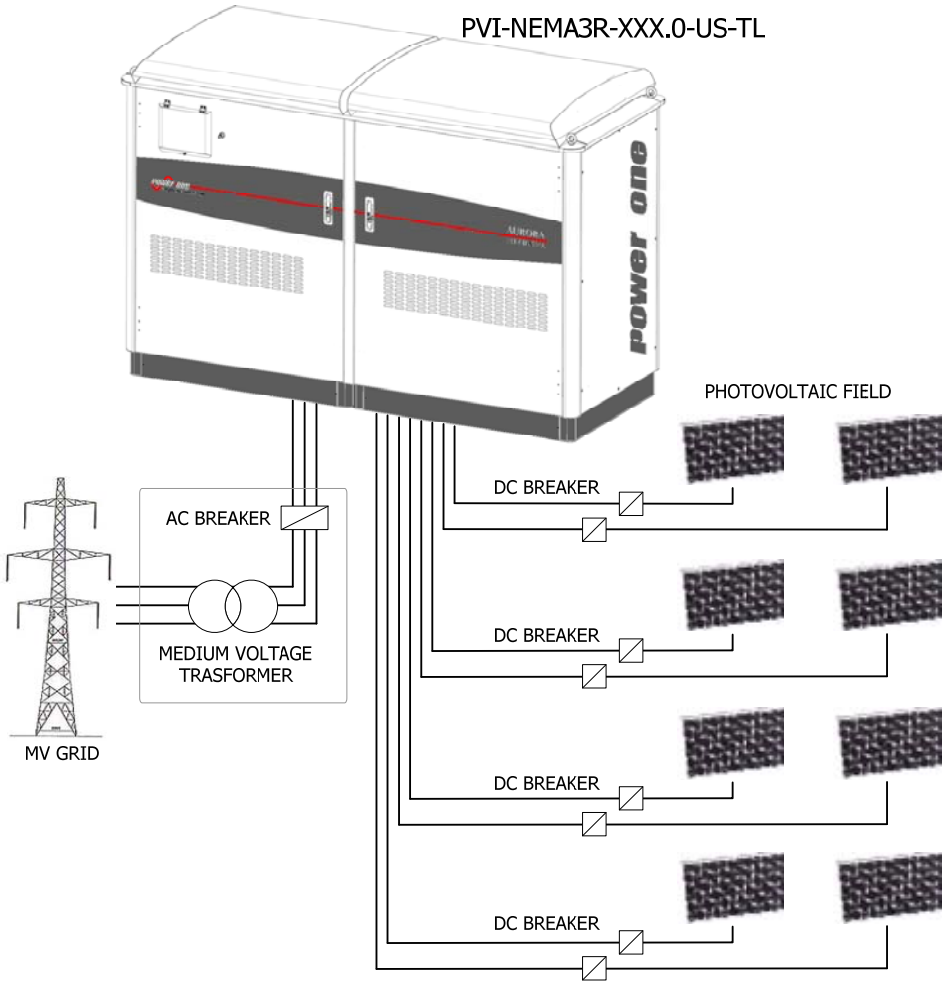


Figure 4-3: Typical Connection Details for a Transformer-less (TL) versions (350KW/400KW) inverter to AC grid

4.1. Technical Description of AURORA PVI-NEMA3R-XXX-US(-TL)

Figure 4-4 shows the block diagram of AURORA PVI-NEMA3R-300-US, which applies to the 250kW and 300kW versions

Figure 4-5 shows the block diagram of AURORA PVI-NEMA3R-400-US-TL, which applies to the 350kW and 400kW versions.
In both configurations, the lower power (250 kW, 350 kW-TL) models have the same block diagram, but are provisioned with a one less 50 kWp module.
Depending on the version, the inverter may or may not be provided with a galvanic isolation transformer between input and output. Transformer-less (TL versions) allows for a further increase in the efficiency of the conversion system, and allows the user latitude to specify a transformer which better matches a specific installation.

What are "50kWp ***MODULES***"?
The PVI inverter is based on modular design. The total output power capability of a given inverter is obtained through use of multiple 50kWp DC/AC inverter ***modules*** and are the core of AURORA PVI-NEMA3R-XXX-US(-TL) design. All inverter modules function at high switching frequency (18 kHz), are very compact and have a relatively low weight, facilitating ease of maintenance.

The block diagram of Figure 4-4 shows the AURORA PVI-NEMA3R-300-US model with its 6 independent 50KW modules connected in a Multi-Master/Slave mode.
The block diagram of Figure 4-5 shows the AURORA PVI-NEMA3R-400-TL model with its 8 independent modules (1Master/N.Slave mode).
The Transformer is usually connected to the inverter output as shown. The customer is responsible for providing appropriate over current protection devices for connection to the grid.

P-1 recommends switches employed be equipped with suitably sized magneto-thermal protection and a rated fault current capability of 1200 A.

Modules can operate in two different modes, depending upon the type of system required. Configuration is done in the factory prior to delivery:
Master/Slave or ***Multi-master/slave*** for models with on-board isolation transformer
1Master/N.Slave for Transformer-less models.

Multi-Master/Slave
In the ***Multi-Master/Slave*** mode, each two slot Framework operates as an independent 100kWp with a pair of 50kWp modules in Master/Slave mode, and has a single maximum power point tracking (MPPT) input.

Chapter §6.1.1

In this mode, the PV fields associated with each Framework are connected in parallel.

4.1.1 1Master/N.Slave (Inverter ≥ 350kW)

In the ***1Master/N.Slave*** mode (used for all –TL inverters) a single Master manages all connected 50KW modules using a single maximum power point (MPPT) channel.

Chapter §6.1.2

In this case, the PV fields connected to all of the associated modules are connected in parallel.

CAUTION

It is important that the operation of the DC input switches be well understood.

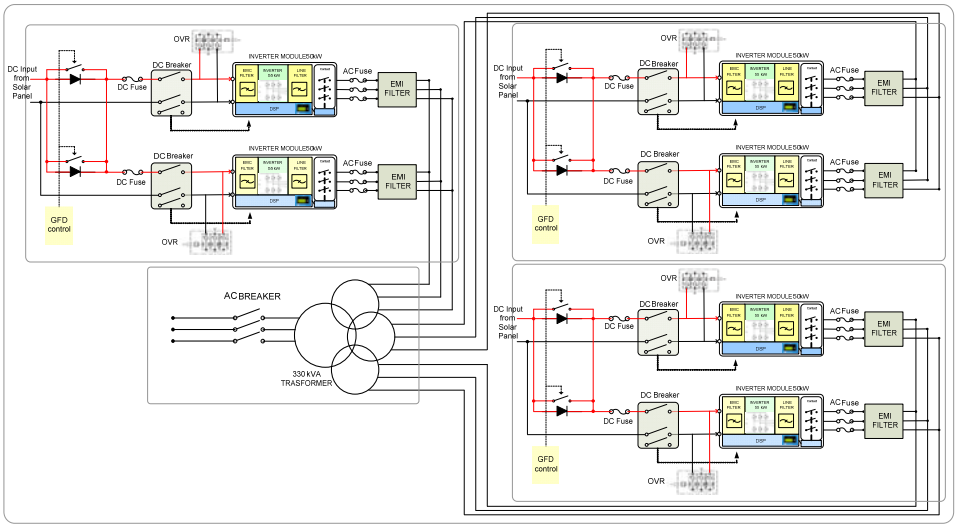


Figure 4-4: Electrical diagram PVI-NEMA3R-XXX-US with Transformer on board

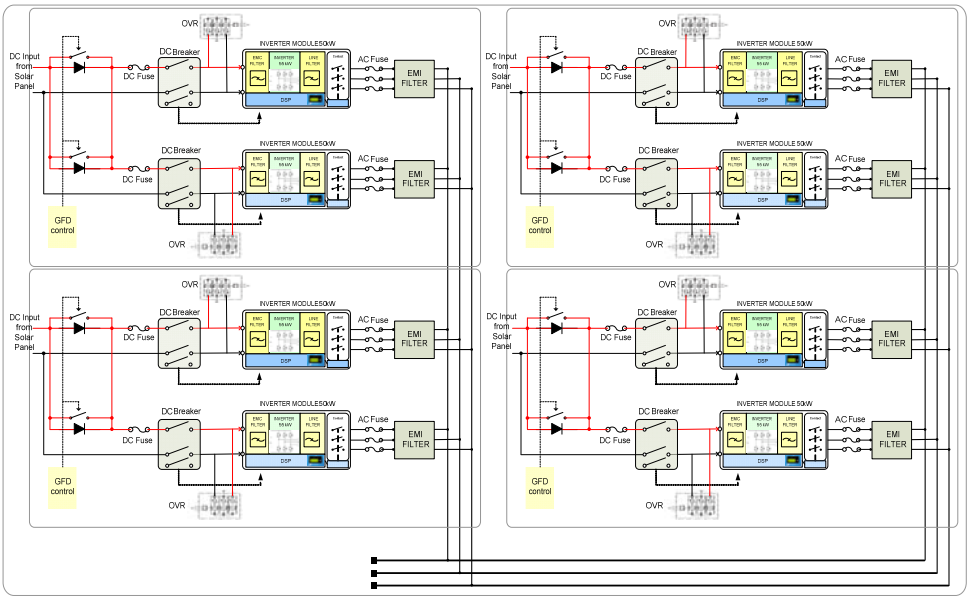


Figure 4-5: Electrical diagram PVI-NEMA3R-XXX-US-TL (Transformer-less versions)

MPPT (Maximum Power Point Tracker)
One great advantage in using the PVI-NEMA3R-XXX-US(-TL) is the ability to extract maximum power from the solar panels, regardless of environmental conditions.
A photovoltaic panel exhibits the curves of current-voltage (I-V in bold) and power-voltage (P-V) shown in Figure 4-6.
An array of identical strings, therefore, has the same characteristic shape. The highest point on the power curve is called the maximum power point. The location of this point varies continuously depending on the level of solar radiation available at the surface of cells.

On days with variable cloudiness, changes in the solar power output of an array can change quickly and in a wide-ranging manner - variations from 100W/m² to 1200 W/m² can be easily detected in about 2 seconds.

AURORA PVI-NEMA3R-XXX-US(-TL) is designed to extract maximum power from the array it is connected to, thus it will always operate at the "knee" (or maximum power point) of the Voltage-Power curve.
Moreover, since the Aurora MPPT has very fast tracking/settling periods, it will produce much more energy than a "slow" inverter on variable days.

PVI-NEMA3R-XXX-US(-TL) scans the PV field each time there is a grid connection, allowing discovery of any possible multiple power peaks in the field characteristic, and the inverter is placed immediately on the highest power peak.

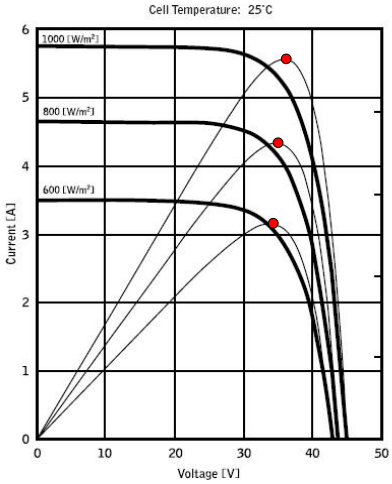


Figure 4-6: Example of I-V curves (Current-Voltage) and P-V (Power-Voltage) of a solar panel

Unlike other inverters, PVI-NEMA3R-XXX-US(-TL) has the ability to follow very fast variations in illumination, allowing the MPPT system to efficiently follow the light practically in real time.

Special features

Due to the high efficiency of AURORA and its generously sized thermal design, it has the ability to dissipate any internally generated heat quickly and easily and insures inverter operation at maximum power over a wide ambient temperature range.

Chapter §0

Each 50kWp module has dual internal controls, made possible by the use of a Digital Signal Processor (DSP) and a central microprocessor. This control design allows the inverter to continue operating even under conditions where one or more slave modules cease operating. Such a condition does not compromise the entire PV system but only the loss of up to 50kWp (per affected module).
In a Multi-Master/Slave system, if a failure of the Master module occurs, under most conditions the slave detects the loss of the master, takes the role of master, and the system loss is also limited to 50KW.
If for some reason, the slave module associated with the failed master does not detect failure of its master, in this case it would also shut down, and the system loss would be limited to 100kWp.
The dialogue between a module's DSP and the Microprocessor occurs via a CAN BUS communication link. The same protocol is also used for dialogue between modules belonging to the same system but within different Frameworks. This division of communication to several links guarantees optimal operation of the entire inverter and a high performance in any isolation and load condition, and always in full compliance with applicable safety standards and prevailing regulations.
For external control and monitoring of the PV system, the inverter has two independent RS485 serial ports:
Inverter monitoring
String combiner monitoring (Aurora string combiners only).

Chapter §8

5. DESCRIPTION OF COMPONENTS AND COMPOSITION OF THE PVI-NEMA3R-XXX-US(-TL)

5.1. Overview

Figure 5-1 shows the main components of the PVI-NEMA3R-XXX-US for the 250kW and 300kW versions with isolation Transformer. The common characteristics for these models is the presence of an isolation Transformer and three FRAMEWORK-(E) (two overlapping and one above the transformer compartment) The main difference between these models is the provisioning of either five or six 50kWp power modules.

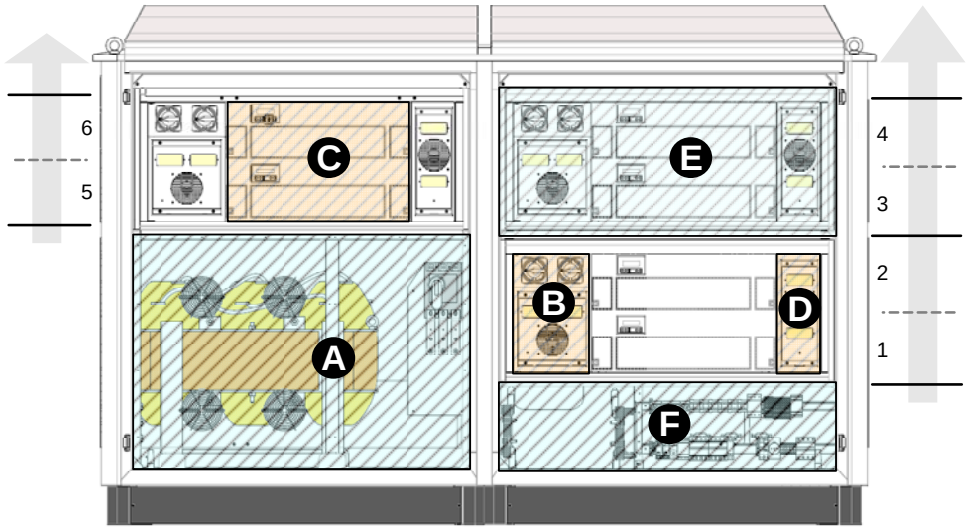


Figure 5-1: General overview of the PVI-NEMA3R-XXX-US (versions 250kW and 300Kw)

For the 350kWp and 400kWp versions, the common characteristics are the lack of an isolation transformer and the presence of four two slot frameworks (overlapped two per side) containing seven or eight 50KwP power modules.

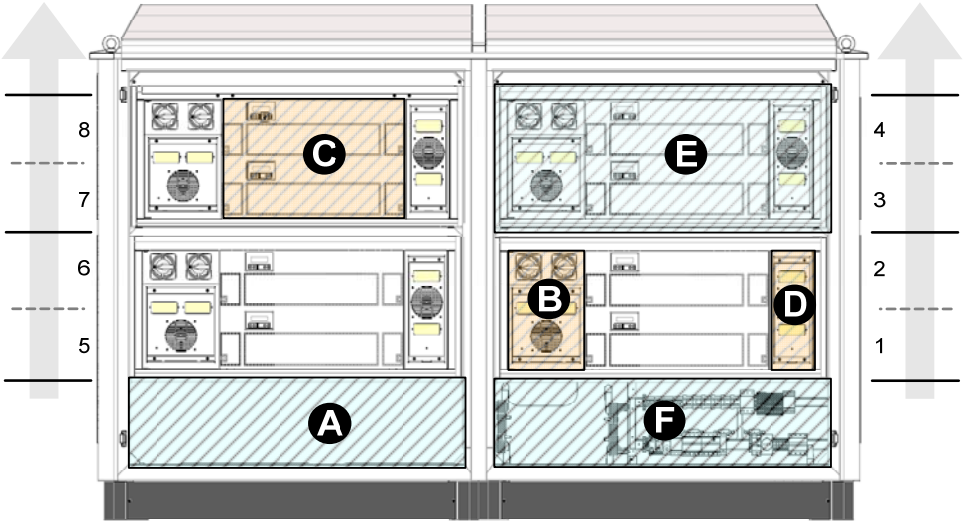


Figure 5-2: General overview of the PVI-NEMA3R-XXX-US-TL (versions 350kW and 400kW[1])

In summary, the difference between the 250 kWp or 300 kWp versions and the 350 kWp or 400 kWp versions is the presence or absence of the isolation Transformer, the number of two slot frameworks and provisioned slots for 50kWp power modules.

1 350kW and 400kW versions have four frameworks.

5.2. Description of the inverter parts

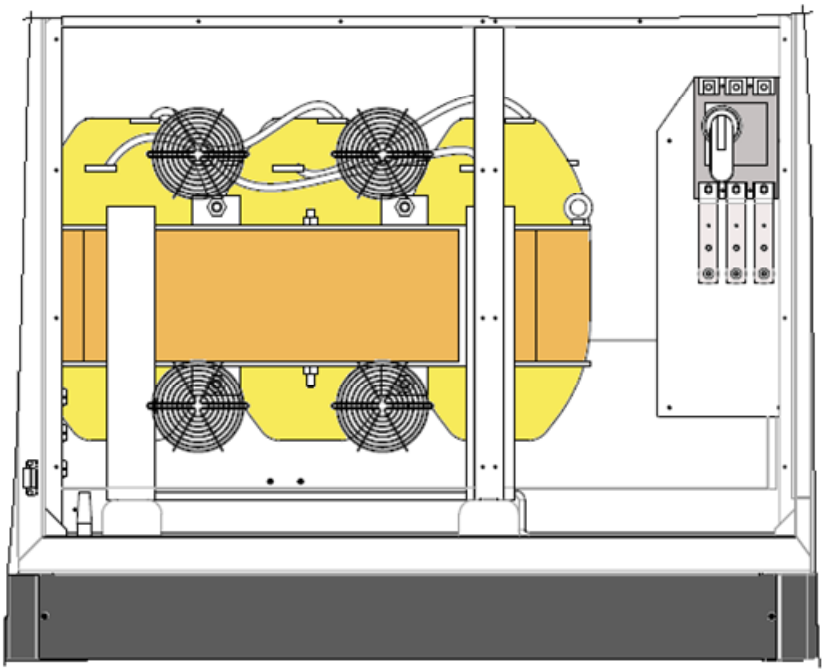


Figure 5-3: Layout of ACBOX (A) for versions with transformer (250-300kWp)

TBD

Figure 5-4: Layout of ACBOX (A) for versions without transformer (350-400kWp)

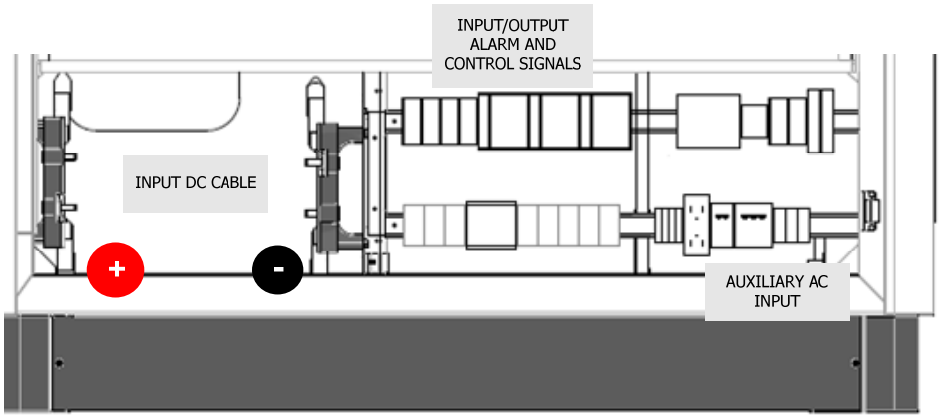


Figure 5-5: Front layout view of ACBOX (area F)

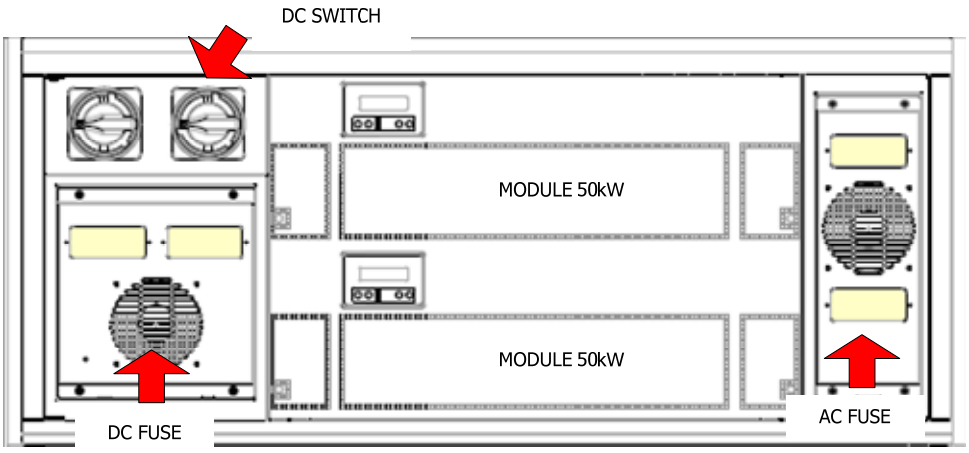


Figure 5-6: Front view of typical FRAMEWORK (area E)

5.2.1 ACBOX (A)(F)

As shown in Figure 5-7, the connection area for DC cables coming into the inverter from the photovoltaic field is located in area (F) of the ACBOX (with frontal view to the left of the inverter). Positive inputs front to back on the left and negative inputs are front to back on the right. The numbers corresponding to the 50kWp modules count from the front (module 1) toward the rear if the cabinet.

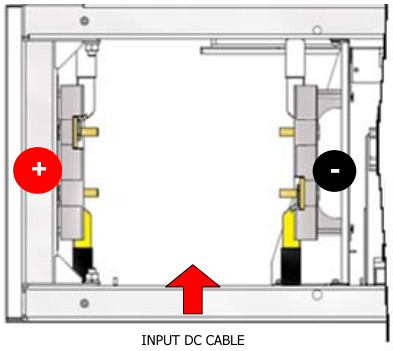


Figure 5-7: DC Cable Input

5.2.1.1 Versions with Transformer

The isolation Transformer is located in the ACBOX of Figure 5-1, area (A).
It is cooled by four fans located on the front panel. The AC breaker with the connection bus bars and the main AC contactor are located in the same compartment, to the right of the transformer. (Figure 5-8)

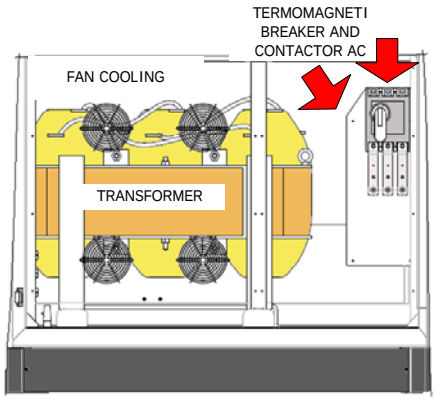


Figure 5-8: AC Cable Input (for NEMA3R-250/300-US with Transformer)

5.2.1.2 Version without isolation Transformer

For models without the Transformer, the ACBOX is shown in Figure 5-2, area (A), and contains only the AC connection bus bars (Figure 5-9).

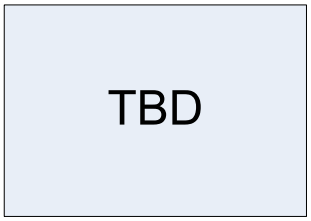


Figure 5-9: AC Cable Input (for NEMA3R-350/400-US without Transformer)

5.2.1.3 Control devices and electro-mechanical parts contained in the ACBOX, area(A)

Figure 5-10 Illustrates the line-up of DIN rail mounted electro-mechanical devices contained in the Transformer compartment. This area contains the overcurrent devices for the AC grid and its respective fuses, the control thermostat and a hygrostat for the compartment in which the Transformer is located.

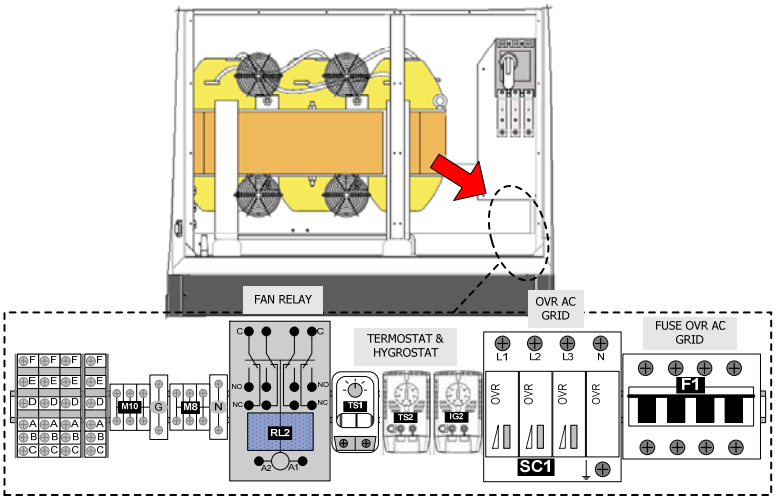


Figure 5-10: ACBOX (A) signal terminal board

5.2.1.4 Control terminal board, devices and electro-mechanical devices contained in ACBOX, area (F)

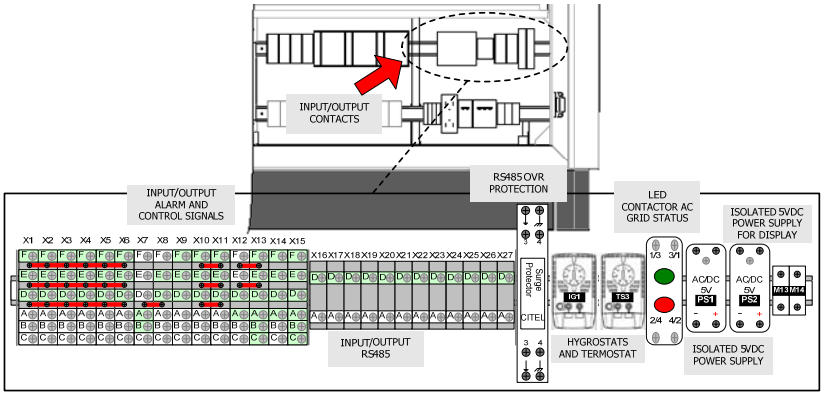


Figure 5-11: Input/Output control and alarm signals (for NEMA3R-250/300-US with Transformer)

Starting from the left side and moving right, Figure 5-11 illustrates the location of the following devices:

- Input and output terminal board for the control signals. The terminal board in the centre allows for serial communication with an overcurrent protection device.
- Hygrostat (HG1) for the detection of humidity
- Thermostat (TS3) for monitoring transformer box temperature
- Status signaling relay for the main AC counter
- Two AC/DC 5V insulated suppliers, PS1 and PS2

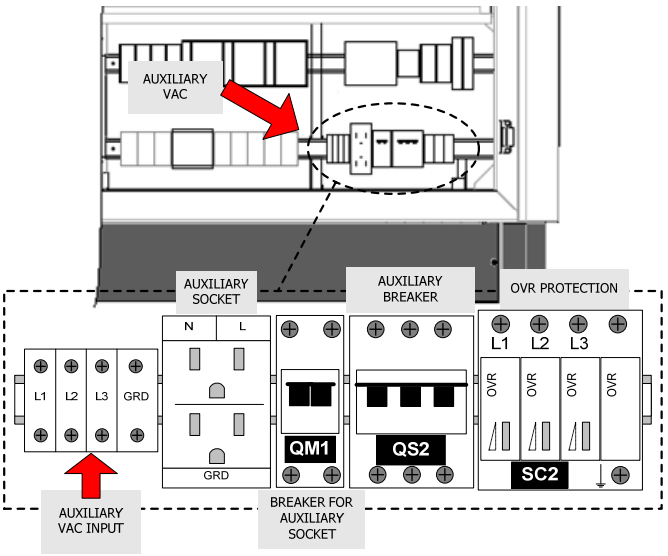


Figure 5-12: Auxiliary AC Input

In Figure 5-11 starting from the left illustrated are:

- The auxiliary supply input terminal board (normally cabled from the inside)
- Duplex socket for service with a dedicated QM1 switch,
- Circuit breaker QS2 for auxiliary voltage
- Overcurrent Protection devices SC2.

TBD

Figure 5-13: Input/Output control and alarm signals (for NEMA3R-350/400-US without Transformer)

Figure 5-14 illustrates the DIN rail mounted distribution terminal boards for auxiliary voltage and the AC/DC supply (PS3) used to power the cooling fans for the fuses located in the framework.

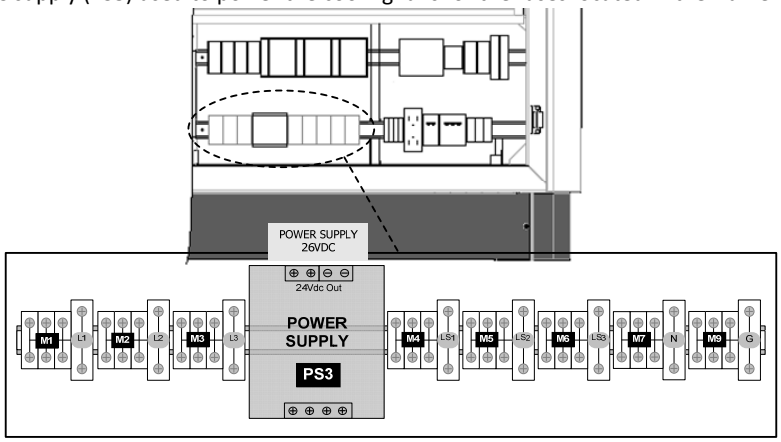


Figure 5-14: Various devices

In Figure 5-15, starting from the left, illustrated is the line-up of DIN rail devices used for:

- ground fault detection (GFD),
- their associated fuses,
- associated control relays for commanding the internal functions (e.g., opening/closing the counter, switching the cooling fans on/off etc).

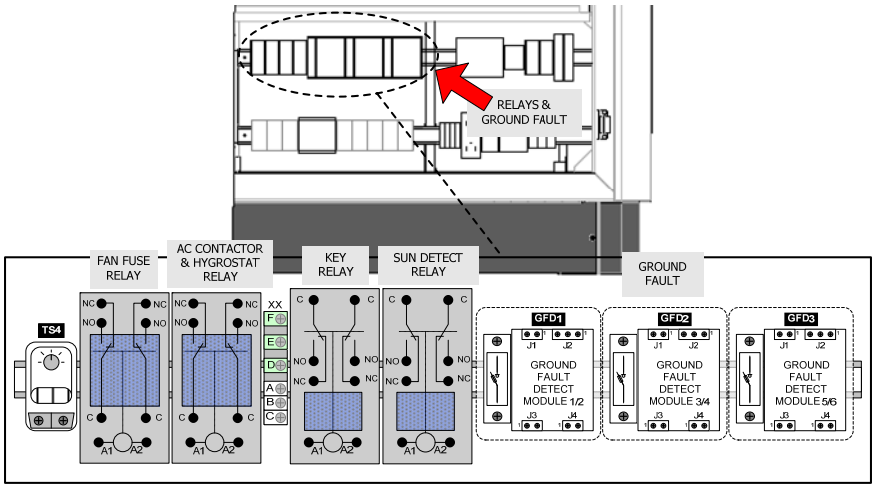


Figure 5-15: Control Relays and Ground Fault Interrupters

5.2.2 50kWp Modules area (C)

The 50kWp module is the heart of the PVI-NEMA3R inverter family, and this area is allows connection of one or two1 50kWp modules that convert PV power into electric power compatible with the distribution grid. Each module is equipped with signaling LEDs and an interactive display.

5.2.3 AC Fuses area (D)

Removing the front panel in this area allows access the fuses on the AC line of each module. In addition, two transparent windows allow visual inspection of fuses.

Chapter §17.1.4.2

5.2.4 Framework area (E)

This section of the chassis contains areas B, C and D and can be provisioned for one or two 50kWp modules. If only one slot is provisioned (250kWp or 350kWp versions) all electromechanical components from the unused slot are not provisioned.

5.2.5 Enumeration of the 50kWp Modules

The numbering of the inverter module slots is as indicated in Figure 5-1 and Figure 5-2. The right-lower module will always have the number 1, while the final number depends on the inverter model (e.g. for the from 250kWp version, the numbering ranges from 1 to 5).

NOTICE

The numbering of the module slots must not be confused with the serial number of the single module. The use of slot numbering of single modules facilitates the connections on the DC side (where there are labels with the corresponding slot numbers.

Chapter §5.1

1 In the case of 250 kW or 350 kW versions, only one module may be present.

6. DESCRIPTION OF THE INPUT CONFIGURATIONS AND DC SWITCHES OPERATION

6.1. Possible field configurations

There are various ways of configuring the AURORA PVI-NEMA3R-XXX-US(-TL) input in order to meet the construction requirements of the photovoltaic field.

Chapter §4.1

The type of configuration depends on the model of the inverter ordered.

6.1.1 Multi-Master-Slave

In this configuration the inverter behaves as up to three independent 100kWp inverters (Figure 6-1 dotted lines), i.e., each Framework works separately with independent MPPT inputs.

Chapter §**Error! Reference source not found.**

This configuration is only available using the 250 and 300kWp versions of PVI-NEMA3R-XXX-US.

The slot position of the Master and the Slave within a Framework is not predefined. The module having the highest serial number is always set as the Master.

6.1.2 Master-Slave with a single Master

In this configuration the entire device behaves as a large single Master-Slave inverter, and therefore has a single Master and one MPPT channel (see Figure 6-2). In this case, however, the following conditions must be fulfilled:
The company or person responsible for the construction of a photovoltaic system must install a DC switch upstream of the inverter input in order to break the entire photovoltaic field circuit.
Particular attention must be given to maneuvering the DC switches.

Chapter §6.1.2.1

This configuration is only available with the transformer-less versions (350kWp, 400kWp) of the PVI-NEMA3R-XXX-US-TL.

The position of the Master and the Slave within an Inverter is not predefined. The module with the highest serial number is always designated by the system as the Master.

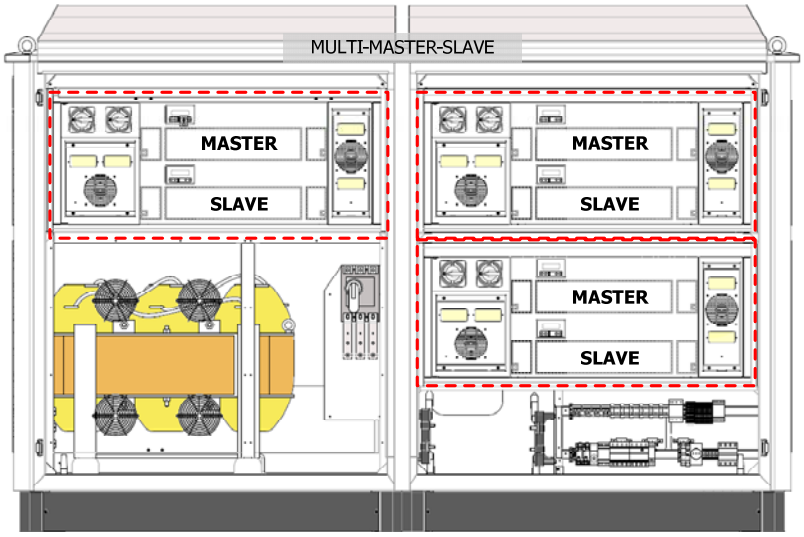


Figure 6-1: PVI-NEMA3R-300-US (Multi-Master/Slave) illustrating three M/S pairs

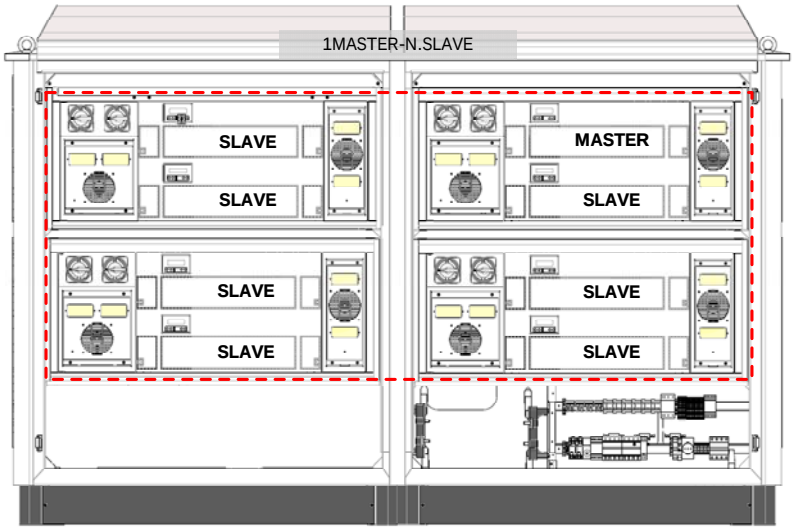


Figure 6-2: PVI-NEMA3R-400-US-TL (1 Master-N.Slave)

6.1.2.1 Features of the external DC switch

It is important that an external DC switch is fitted according to these characteristics:

- Earth isolation: 600 Vdc.
- Rated voltage: 600 Vdc.
- Rated current: 170 A x number of Modules (example, PVI-NEMA3R-400: 170x8 = 1360 Adc).

Check the serial connection mode of the poles of the switch to ensure breaking at 600 Vdc.

In case of switches with thermal breakers, make sure the temperature threshold does not interfere with the maximum allowable room temperature for operation.

6.2. Function of the DC disconnecting switches in every Framework

Inside the side panel, the switch on the lower right side acts on the connection of the low module (L-Low), while the switch on the top right acts on the high module (H-High).

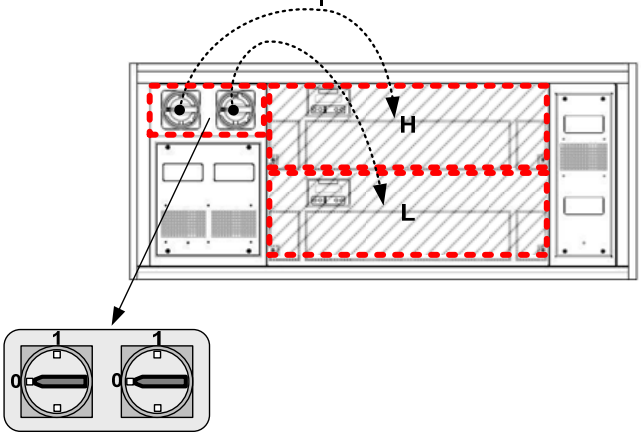


Figure 6-3: Framework - detailed action on DC switches

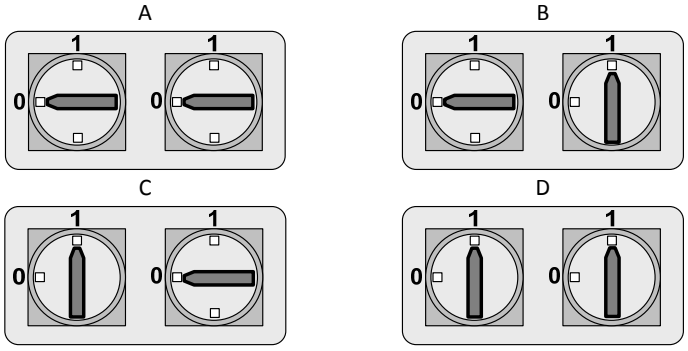


Figure 6-4: Possible switch positions

Every Framework can contain up to a maximum of two 50kWp modules.
In a Framework set-up for a single 50kWp module, only the lowest slot will be populated.

6.2.1 Multi-Master-Slave System (PVI-NEMA3R-250/300-US)

In this configuration, the two modules of the Master-Slave Framework have the same PV field. Each of the two DC disconnecting switches in a common framework is linked together.

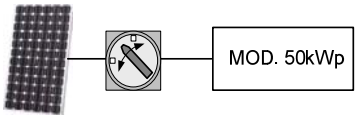
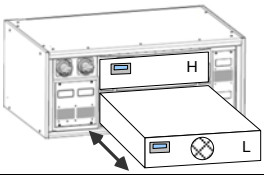
NOTICE

In this case, it is particularly important to understand the use of the DC disconnecting switches. Improper use may cause the inverter to break-down.

The following table indicates the position of the switches in the first column, and in the second whether the PV field is connected to the module, and in the third whether the specific 50kWp module can be removed or inserted in the slot.

Table 6-1: PERMISSIBLE POSITIONS AND OPERATIONS OF THE DC INPUT SWITCHES

MULTI - MASTER – SLAVE (Inverter ≤300kW)

Position Disconnecting switches DC **Figure 6-4**	Physical CONNECTION between DC source and Module 		Withdrawal / Insertion of Modules* 	
	H (high)	**L** (low)	**H** (high)	**L** (low)
A	NO	NO	YES*	YES*
B	YES	YES	NO	NO
C	YES	YES	NO	NO
D	YES	YES	NO	NO

*before removing a 50kWp module, wait 5 minutes after the last disconnecting switch was positioned to OFF (0 position).

6.2.2 1Master-N.Slave System (PVI-NEMA3R-350/400-US-TL)

In this configuration, the inputs of all modules are connected in parallel and connected to a common PV field. All DC disconnecting switches are linked to one another.

NOTICE

In this case, it is particularly important to understand the use of the DC disconnecting switches. Improper use may cause the inverter to breakdown.

The following table indicates the allowed operations for the DC switches of each framework, according to the position of the external DC switch.

Table 6-2: ADMITTED OPERATIONS AND POSITION OF THE DC SWITCHES

1 MASTER – N. SLAVE (Inverter ≥ 350kW)

Switch Position external DC Disconnect	**POSSIBLE ACTIONS ON DC SWITCHES**	**PROHIBITED ACTIONS ON DC SWITCHES**
OPEN (OFF)*	After 5 minutes of the opening of the external switch, the switches can be operated without problems*	–
CLOSED	DC disconnecting switches can be opened after having turned off the relative module via remote OFF, or after having disconnected the AC grid.	Open switches cannot be closed (in this case it is absolutely necessary to first open the external disconnecting switch and wait 5 minutes)
*before extraction, wait 5 minutes after the external disconnect has been switched OFF (0).		

7. PROTECTIONS

7.1. Protection for grid failure - Anti-Islanding

When an interruption of the local distribution grid occurs for whatever reason, safety standards require the grid connection to the inverter to be physically opened thereby insuring a safe condition on the grid, which allows personnel to work on the grid without a potential for shock hazard. To avoid possible islanding operation, all Aurora inverters are provisioned with an automatic anti-islanding disconnection system.

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Chapter §22
Chapter §0

7.2. Additional protection

In addition Aurora inverters are all equipped with additional protections to guarantee the safe operation under any circumstances. In addition to anti-islanding function noted above other such protections include:
Constant monitoring of the mains voltage to guarantee that the voltage and frequency values remain within operating limits (according to standards in force in the country where it is marketed).
GROUND FAULT DETECTOR/INTERRUPTOR: a special device determines if current to ground too high and if so, disconnects the inverter from the grid and registers a fault and alarm the DC side.

Chapter §11.6

An internal temperature control to automatically limit power if necessary and to guarantee that the unit does not overheat. The graph in the Figure 7-1 and Figure 7-2 shows the automatic derating of delivered power.

Figure 7-1: Power derating 250/300kW

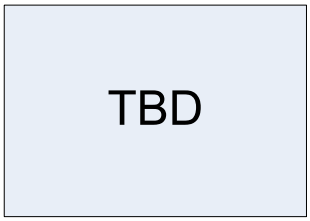

Figure 7-2: Power derating 350/400kW TL

AURORA's many control and protection devices that result in a redundant system that guarantees operation in absolute safety.
Automatic measures:

- The DC voltage of the photovoltaic field is measured and if too high, an overvoltage (OV) fault is signaled on each module independently.
- The independent AC voltage on each module is measured.
- AC output current of each module is measured independently.
- The grid voltage frequency is measured on each module independently

- Independent thermal measures on each module.
- Protection fuses:
- DC side: A DC fuse is provisioned for all active slots in every framework.
- AC side: Three fuses are provisioned for each module slot, for a total of 6 fuses per framework.

Other protective measures:

- Magneto-thermal switch at the input of the auxiliary supply network.
- Magneto-thermal switch at the input of the distribution grid (480 Vac).
- DC side: protections against over-voltages (OVR), with replaceable cartridge fuses.
- AC side: protections against over-voltages (OVR), with replaceable cartridge fuses on the 480Vac grid and the auxiliary voltage.
- Protection against over-voltages (OVR), with replaceable cartridge fuses on the RS485 serial line.
- Protections against overheating incorporated into each module.

8. RS485 SERIAL LINE

8.1. Connection modalities of the RS485 line

To allow remote monitoring of the PVI-NEMA3R-XXX-US(-TL) an RS485 serial data communications bus is used. Up to 32 inverters can be connected to the same line.

The inverter is provisioned with a switchable line termination (120 ohm) resistor.

NOTICE

For a system using a group of PVI-NEMA3R-XXX-US(-TL) inverters are daisy-chain connected to the same communication bus, the last inverter in the chain must have the line termination resistor enabled (Figure 8-1, Figure 8-2); all others must have it disabled.

Chapter §11.7.2

The use of a computer is not required for operation of the system and only necessary for functional verification during installation and system monitoring from a PC.

Chapter §16

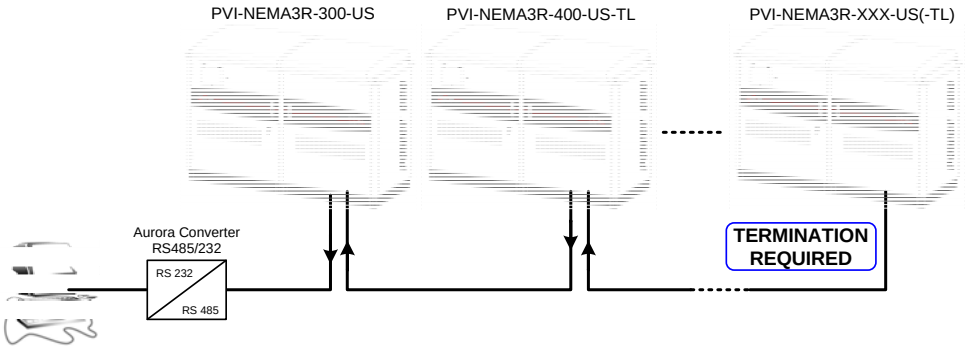

Figure 8-1: Wiring method of the PVI-NEMA3R-XXX-US(-TL) communication serial cable

The RS-485 communication bus can be utilized to connect a number of the PVI-NEMA3R-XXX-US(-TL) inverters via a "daisy-chain" wiring method. It is possible to connect inverters of different types and sizes.

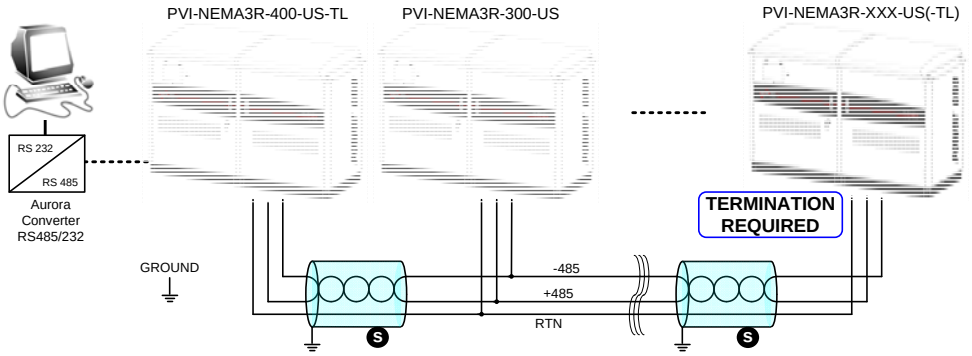

Figure 8-2: RS-485 bus wiring detail for the PVI-NEMA3R-XXX-US(-TL)

8.2. Connection modes for monitoring

There are two primary modes (A and B) used to connect the RS485 line from the PVI-NEMA3R-XXX-US(-TL), in order to monitor the inverter operation, while two other modes (C and D) do not require the RS485 connection. Figure 8-3 depicts these modes:

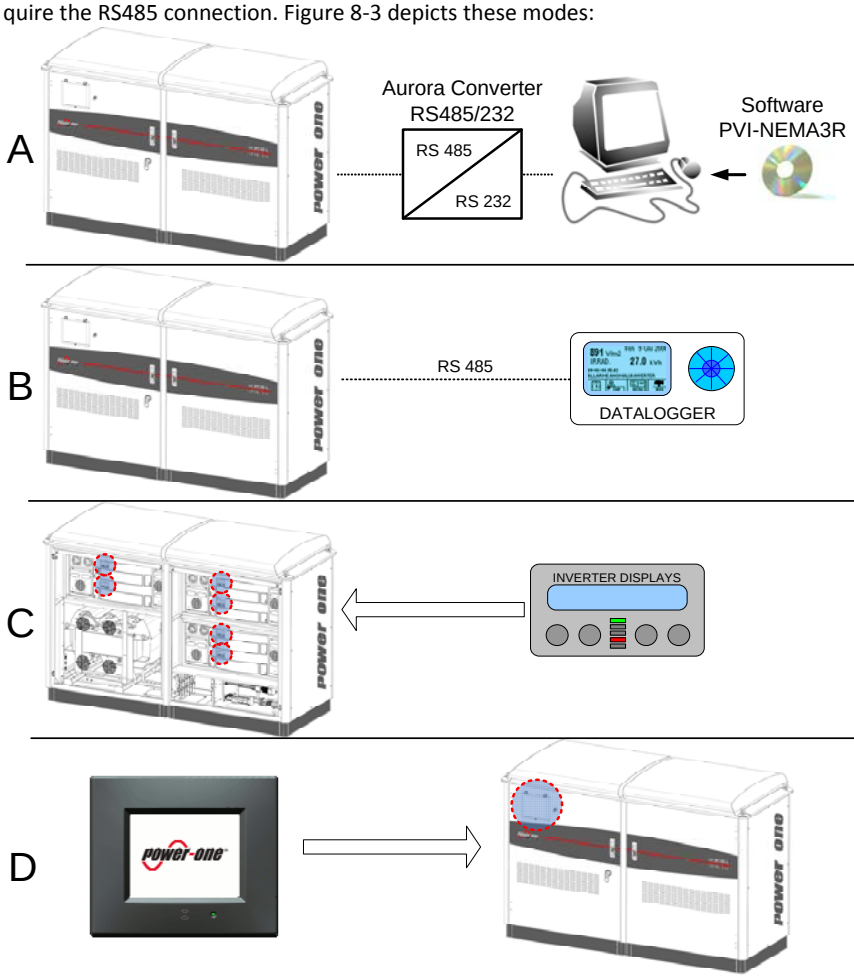

Figure 8-3: Connection modes

Where:

A. Connection to the PVI-NEMA3R-XXX-US(-TL) with a PC.

A computer is connected to the RS485 of the inverter via use of the Aurora RS232/485 adapter. The PC used must have the monitoring software installed for the PVI-NEMA3R-XXX-US(-TL). This is the configuration used during installation and monitoring via PC.

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Chapter §16

B. Connection for remote control.

The Aurora Easy Control remote monitoring system is connected directly to the RS485. For the operation of this system, see the Aurora Easy Control user manual.

C. Stand-Alone Connection at Module 50kW.

The monitoring of the PVI-NEMA3R-XXX-US(-TL) occurs only through the display of the 50kWp MODULES.

Chapter §13

D. Stand-Alone Connection at PVI-NEMA3R-XXX-US-(-TL).

The monitoring of the PVI-NEMA3R-XXX-US(-TL) is via the front panel display on the front door of the inverter

Chapter §14

9. STORAGE AND HANDLING

9.1. Preliminary checks

The dealer has safely delivered your AURORA to the forwarding agent in perfect condition. The forwarding agent, by accepting the package, assumes responsibility until delivery. In spite of the care taken by the forwarding agent, the packaging and its contents may be damaged during transport. Handling and storage of the device before installation require particular care. It is therefore necessary to follow the instructions below.

NOTICE

Transport and storage temperature limits must be observed.

Chapter §0

NOTICE

Since there are electronic circuits and electrical connectors in the inverter, particular care must be exercised to avoid mechanical shock from drops and high vibration conditions which could later endanger the correct functioning of the inverter and/or compromise the safety of persons during installation and/or operation.

NOTICE

It is important, before installation, to check that the device is undamaged. Any anomalies in packaging and/or the presence of loose objects inside the unit must be reported to the dealer.

The customer should carry out the following checks:

- Examine the shipping container for signs of visible damage: holes, cracks and any other sign of possible damage inside.
- Describe in writing any damage or lack of documents received; if possible supporting photographs are encouraged. This documentation must be undersigned by the carrier, with his full name.
- Open the shipping container and examine the contents for signs of any damage inside. When unpacking use care not to discard any equipment, components or manuals. If any damage is found, contact the forwarding agent to determine the best measures to take. An inspection may be required;
- Be sure to retain all packaging material for the inspector!

If the inspection reveals damages, call an authorized dealer for a decision whether the equipment should be returned for repair and provide instructions in this regard.
It is the customer's responsibility to register a formal complaint with the forwarding agent. Failure to follow this procedure can lead to the loss of assistance under guarantee for any damages found.

9.2. Handling and withdrawal of the PVI-NEMA3R XXX.0(-TL) from the packaging

The inverter is packaged for shipment in a wooden crate.

NOTICE

The handling of the inverter in the crate must be done following the instructions in this manual. Chapter §0

9.2.1 Content of the packaging

Each package contains the following materials[1]:

Material	Qty
PVI-NEMA3R-XXX-US-TL	1
Mechanical Parts	4
This Manual	1
Final Test Documents	1
CD (Software)	1

1 There may be differences pursuant to agreements with the customer.

9.2.2 Removal of the inverter from the wooden crate

NOTICE

The packaging of the PVI-NEMA3R-XXX-US(-TL) is shown as in Figure 9-1. To withdraw the inverter it is necessary to first remove the lid of the crate, and then the side panels.

Figure 9-1: Transport crate

After removing the crate top and sides of the crate, remove the internal protection wrapping. The mechanical parts that make up the base are packaged separately and positioned inside the crate. These parts must be assembled after the inverter and the all connection cables have been placed in their final positions.

9.2.3 Handling of the PVI-NEMA3R-XXX-US(-TL)

After opening the crate, the inverter may be withdrawn.

NOTICE

Extraction of the device from the packaging and its positioning must be performed with the help of specific equipment and according to the instructions in Figure 9-2. Please keep in mind that the weight of the inverter is not uniformly distributed and therefore use extreme care when lifting it.

NOTICE

The inverter may be moved by forklift truck. Since much of the weight is distributed in the upper half of the chassis, it is absolutely essential to use extreme caution when moving.
It is important to lift the inverter in a way which guarantees the widest supporting base possible and which minimizes the risk of tipping over.

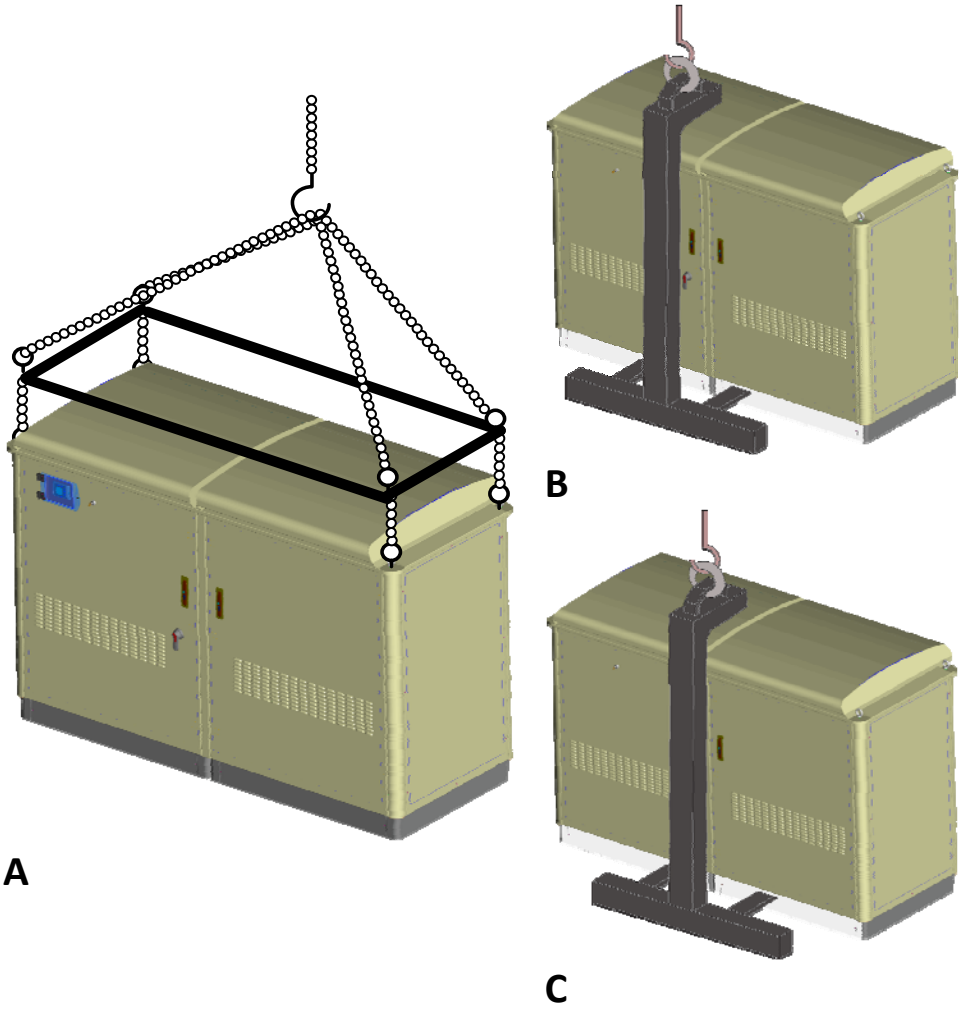


Figure 9-2: Allowable Handling Techniques

Figure 9-2 illustrates the recommended handling procedures for PVI-NEMA3R-XXX-US-(-TL). In figure A, it is advisable to use the framework shown as pivot to keep the lifting chains in a vertical position in relation with the eyebolts. Figures B and C illustrate alternative lifting procedures, respectively for models 250/300 kW (with Transformer) whose center of gravity is located in the transformer area shown in figure B and for models 350/400 kW (without Transformer) Figure C.

10. INSTALLATION

DANGER

The electrical installation of the PVI-NEMA3R-XXX-US(-TL) must be carried out in compliance with the prevailing codes and regulations. All cables used and connected to the device or under field voltage, must comply with the minimum insulation rating of 600Vdc. In case the low voltage cables are carried together with the wires from the photovoltaic field, the installer must ensure that the main electrical insulation conditions are guaranteed.

10.1. Installation location

The physical environmental and positioning situation and the position may affect proper functioning of the PVI-NEMA3R-XXX-US(-TL). The following warnings and recommendations are related to the choice of location are being provided with regard to the position of the inverter:

NOTICE

Do not install the device in a position where it is directly exposed to the rays of sun: excessive temperatures could reduce inverter performance. If possible, install the inverter in a position protected from sun, as positioning in direct sunlight could in some cases negatively affect inverter performance due to excessive internal temperatures.

NOTICE

While the NEMA3R design limits the effects of airborne water and dust, the quality and quantity of the air, humidity and dust can affect proper functioning and long term operation of the inverter.
In the design phase of the plant, data concerning environmental and ventilation conditions should be considered

Chapter §0

WARNING

The inverter must be located in a flame-proof area: there must be no flammable material within the vicinity.

WARNING

Do not place the PVI-NEMA3R-XXX-US(-TL), near inhabited areas or in places with difficult access. Any fire escape routes must always be left open.
THE INSTALLATION LOCATION MUST BE ACCESSIBLE AT ANY GIVEN TIME BY AUTHORIZED PERSONNEL.

Hardware maintenance of the inverter is carried out mainly from the front (either the modules area or the AC BOX area as shown in Figure 5-1 and Figure 5-2, however, it is necessary to allow access on all sides in order to facilitate any possible servicing need.

10.2. Positioning in the selected place and characteristics of the support base

The inverter must be placed on a base which guarantees its vertical position and adequately support the weight.

Chapter §0

The mounting pad for the inverter must be designed according to these criteria:
It must be capable of sustaining the weight of the inverter.
It must be of reinforced concrete.
It must be level.
The pad surface flatness must not exceed 0.1 inch per meter. (0.03”/ft)
Dimensions of the mounting pad must be at least 10% greater than the outside dimensions of the inverter.
The mounting pad must contain openings for the passage of the cables, conforming to the cable passage areas on the base of the inverter.

Figure 10-1 shows the dimensions of the inverter's base (the base anchorage points are highlighted (Figure 10-3)).
Figure 10-2 shows the cable passage.

NOTICE

The inverter must be positioned vertically and not obliquely. The unit must be absolutely stable and perfectly level.

The pad on which the inverter rests must be provided with anchorage points to insure the inverter cannot be shifted accidentally (Figure 10-3).

Leave sufficient space around the inverter to allow for easy installation and removal from the positioning surface. (Figure 10-4)

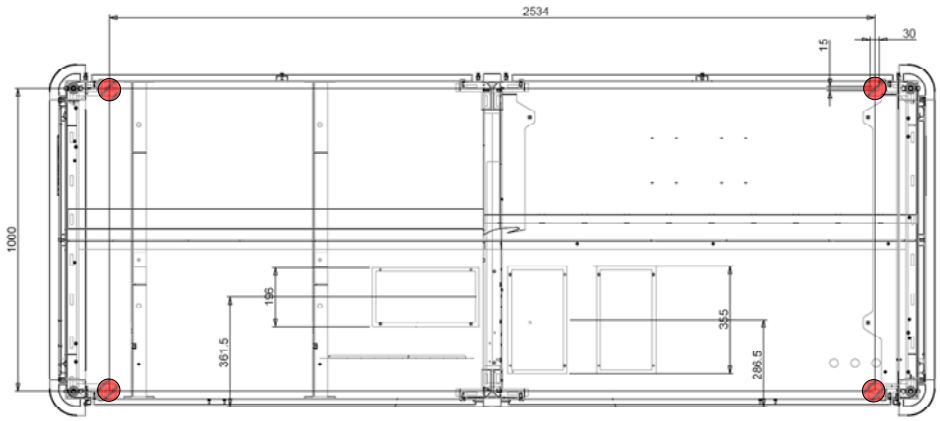


Figure 10-1: Footprint of the inverter base

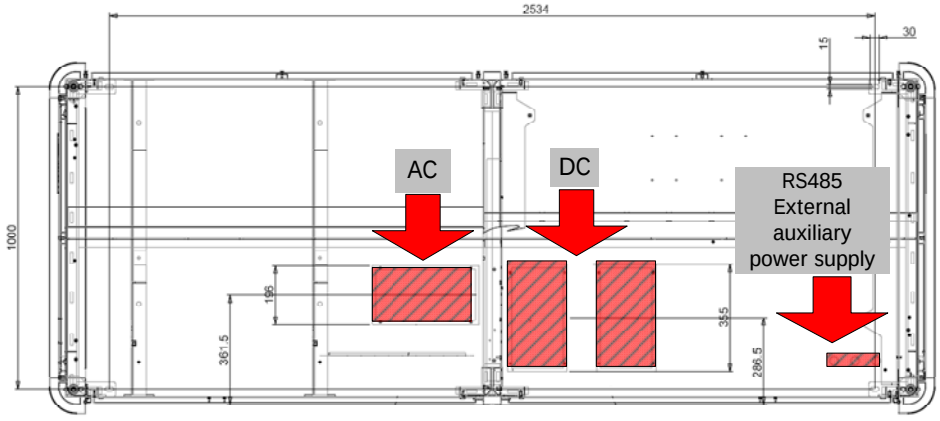


Figure 10-2: Cable passage areas

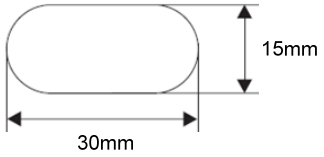


Figure 10-3: Inverter base anchorage hole dimensions

10.2.1 Safety distance

The figure and the table below indicate the minimum distances that should be kept:

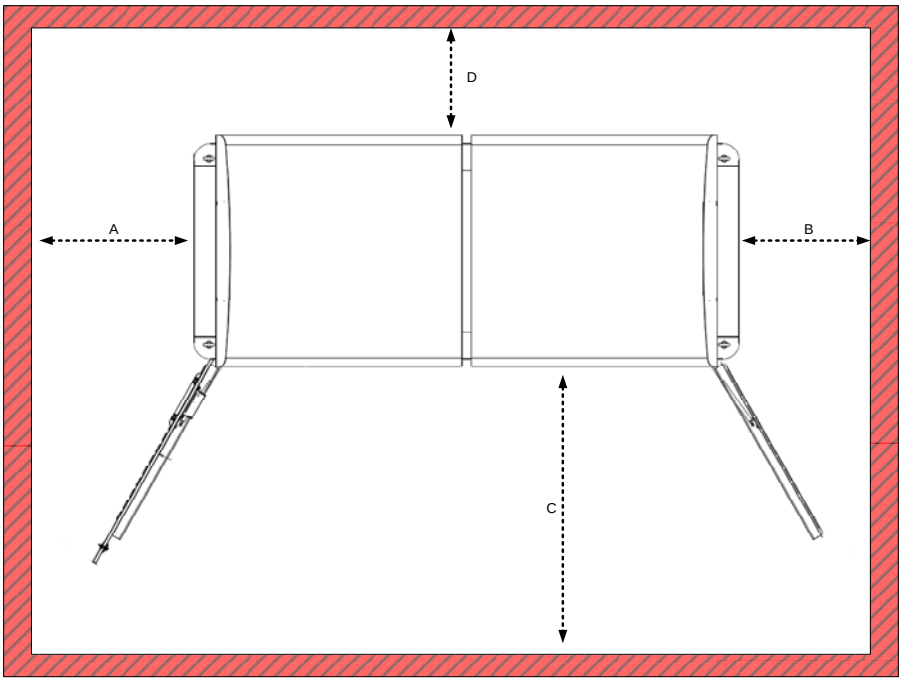


Figure 10-4: Safety distances required around the inverter

Table 10-1: Table of recommended distances

A	B	C	D
600mm (24”)	600mm (24”)	1500mm (60”)	800mm (24”)

10.2.2 Accessible step area

The figure and the table below indicate the minimum dimensions for a step area around the inverter which will ensure optimal access to all inverter parts.

For safe removal of a 50 kWp module, it is absolutely necessary to have a stable area around the extraction area that can support the module weight and be stepped upon in order to operate in safe conditions.

Chapter §19.5

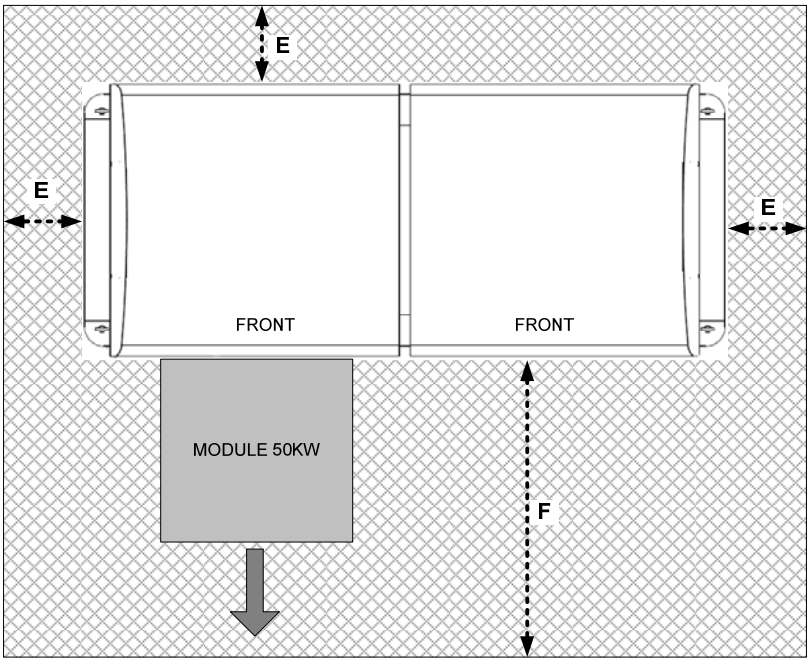


Figure 10-5: Step access area

Table 10-2: Table of recommended distances for access area

E	F
500mm (2 ft)	1000mm (4 ft)

10.2.3 Air vents

Air is suctioned through the front of the inverter and exhausted out from the rear as shown in Figure 10-6.
The air input area contains removable, washable filters.

Chapter §17.1.1

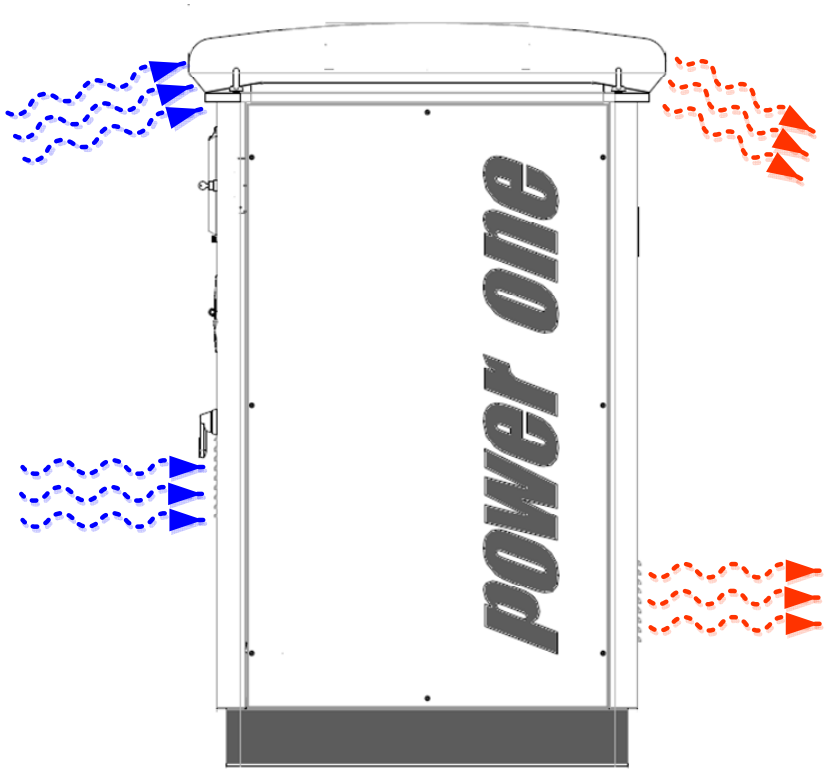


Figure 10-6: Airflow path through the inverter

10.2.4 Removal of panels to make the connections

Remove the panels indicated below in the Figure 10-7 and Figure 10-8:
Remove the panel covering area (G) to access to connections for connection to AC mains at 480Vac or 208Vac.[1]
Remove the panel covering area (H) to access to connections of the auxiliary voltage that feeds the control logic, the internal fans and also access to the terminal block containing the connections for RS485 communications.
Remove the panel covering area (L) to access input connections from the PV array DC.

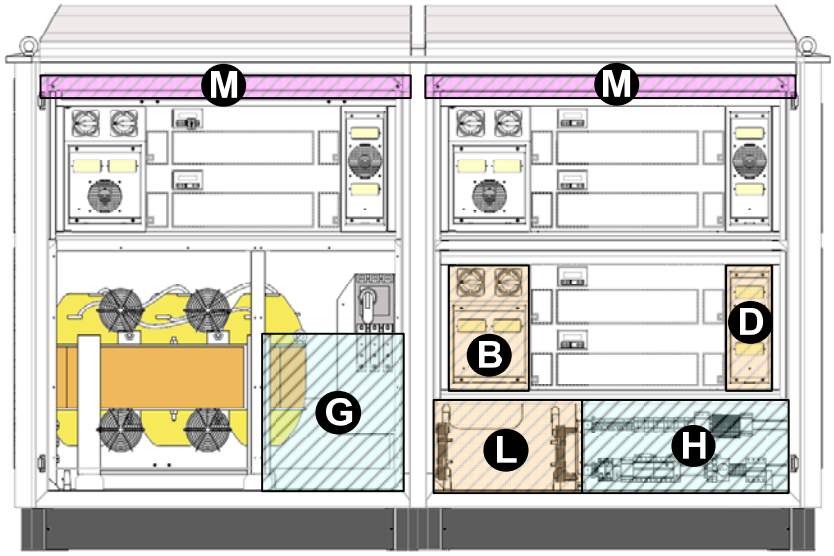


Figure 10-7: Access panels to be removed for PVI-NEMA3R-250/300-US

1 Version 350kWp and 400kWp

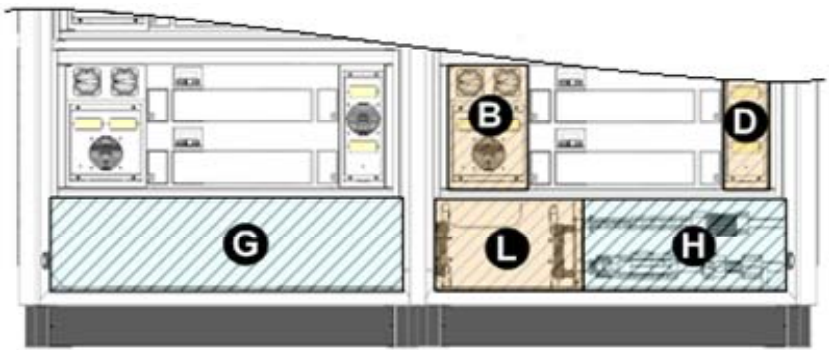


Figure 10-8: Panels to be removed for PVI-NEMA3R-350/400-US-TL

To remove the metal panels it may be necessary to disconnect the earth connection wiring (jumper). Remember to reconnect these wires on every panel before reclosing!

10.2.5 Composition of the ACBOX area

After removing the front panel, the following area can be identified:

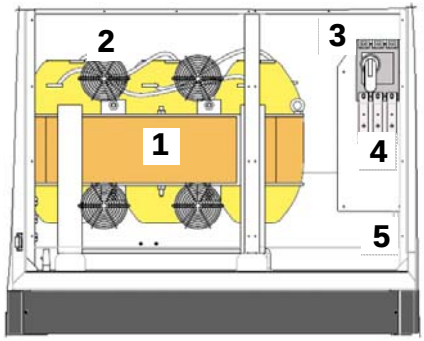


Figure 10-9: Composition of the ACBOX (A) for PVI-NEMA3R-250/300-US

1. Isolation Transformer.
2. Transformer cooling fans
3. Magneto-thermal breaker and protection switch and, on the rear, transformer breaking contactor.
4. AC power network connection bars.
5. Transformer connection Contactor.

For models without Transformer, after removing the front panel the following areas can be identified:

TBD

Figure 10-10: Composition of the ACBOX (A) for PVI-NEMA3R-350/400-US-TL

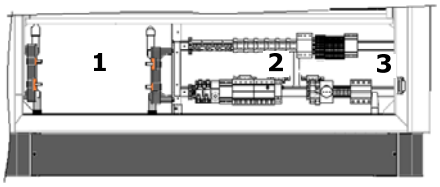


Figure 10-11: Composition of the ACBOX (F)

Where:

1. DC cable connection area.
2. Terminal blocks for connection of auxiliary AC input and RS-485 serial communications.
3. Location of thermostat and hygrostat for monitoring transformer conditions, and OVR AC side protection.

10.2.6 Cable passage area

Figure 10-12 and Figure 10-13 show the correct positioning of the inverter input/output cables.
Pass the DC, AC, auxiliary AC, ground and RS485 through the openings in the base of the inverter (Figure 10-2).
These openings can easily be drilled to adapt to the position of the cables.

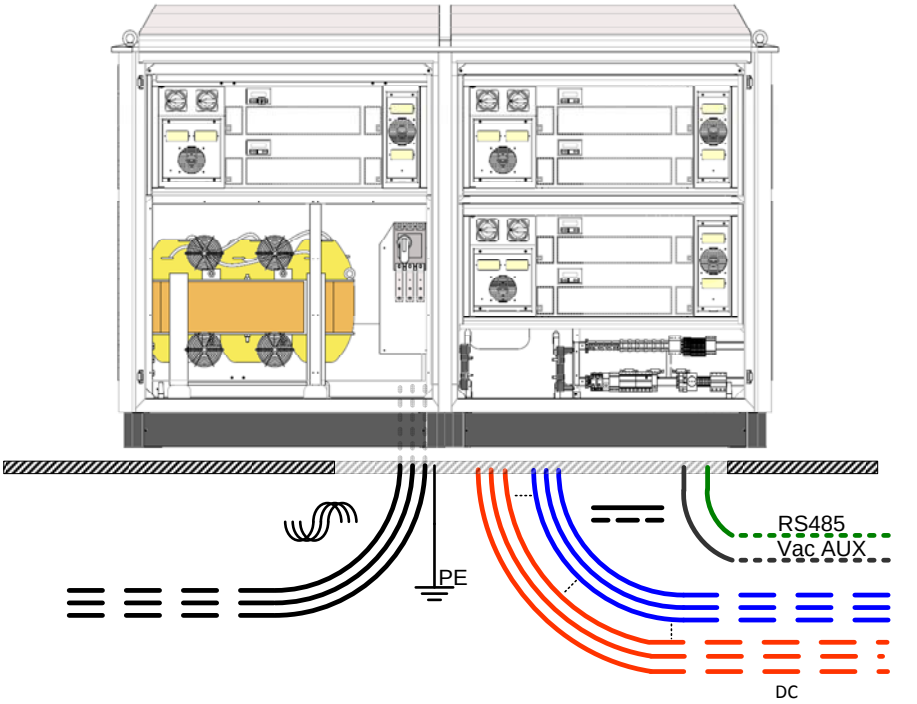


Figure 10-12: Cable output under the PVI-NEMA3R-250/300-US

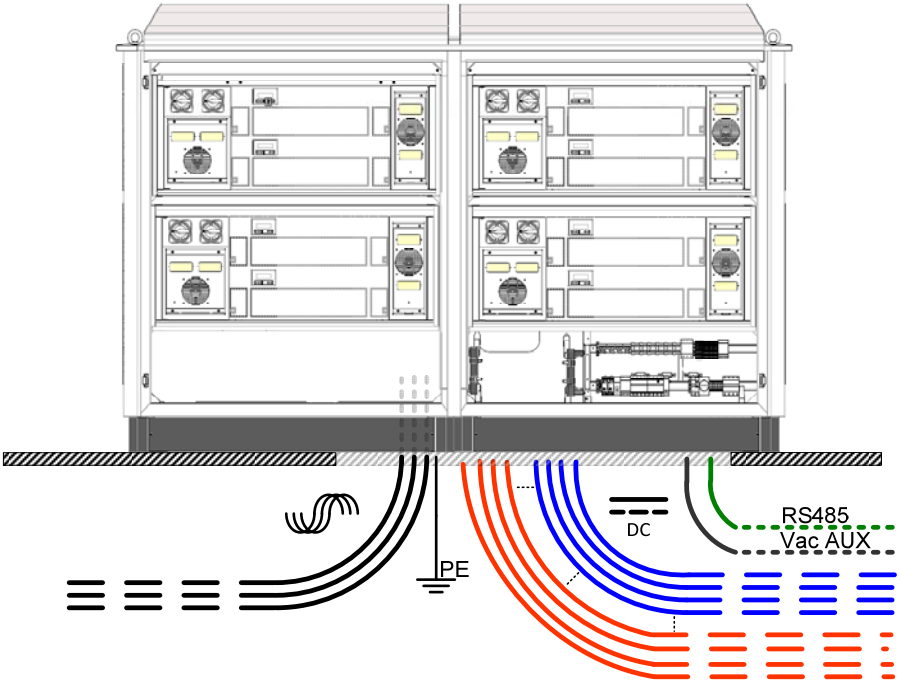


Figure 10-13: Cable output under the inverter PVI-NEMA3R-350/400-US-TL

11. ELECTRICAL CONNECTION

DANGER

Before handling any cable, make sure, using suitable instruments, that there is no hazardous voltage present.

WARNING

The connection of AURORA to the electrical grid must be carried out only by qualified operators and only after having received authorization from affected utility and the authority having jurisdiction (AHJ).

WARNING

CAUTION: To reduce the risk of fire, connect Auxiliary Input only to a circuit provided with 25 amperes maximum branch circuit overcurrent protection in accordance with the National Electrical Code, ANSI/NFPA 70.

Output circuits must be isolated from the enclosure and system grounding, required by Sections 690-40 and 690-42 of the National Electric Code, ANSI/NFPA 70, and is the responsibility of the installer.

Wiring methods should be per the National Electric Code, ANSI/NFPA 70 and/or any prevailing local codes and regulations.

11.1. Preliminary operations for the electrical connection

This chapter provides details of each single operation to be carried out during the connection phase of the installation. The instructions provided in this chapter (and in its sub-chapters) and all the safety warnings should be read carefully and followed step by step.

Any operation which does not comply with these instructions could create a situation of danger for the operator/installer and damage the appliance.

It is extremely important to disconnect the photovoltaic field before making the connection to the inverter by means of the upstream DC switches, since there could be hazardous voltages present capable of causing electrocution and/or a fire hazard.

Do not exceed the nominal voltage and current specifications when designing the PV system. In particular, always keep in mind the following with regard to the photovoltaic system:

Maximum array DC voltage input to each of the MPPT circuits found under any conditions.

Maximum array DC current input to each of the MPPT circuits found under any conditions.

Chapter §0

11.2. Connection of the DC cables from the photovoltaic field

After having carefully read and understood the premises of the preceding paragraphs, the cables from the photovoltaic field can be connected.

Chapter §6
Chapter §10.2.4

As the configuration is made before delivering the inverter, only the DC cables must be connected.

Follow the directions in the points and of the following figures:

- Locate the DC cables from the photovoltaic field.
- Connect the cables in the input terminal block (Figure 11-1) respecting the correct polarities.
- Follow the numbering of the input bars according to the numbering of modules 50 kW.

Chapter §5.2.1

After the cable passage it is important to make sure that the open holes are closed, e.g. by means of expanded foam. This operation guarantees that no animals or dust can access the interior.

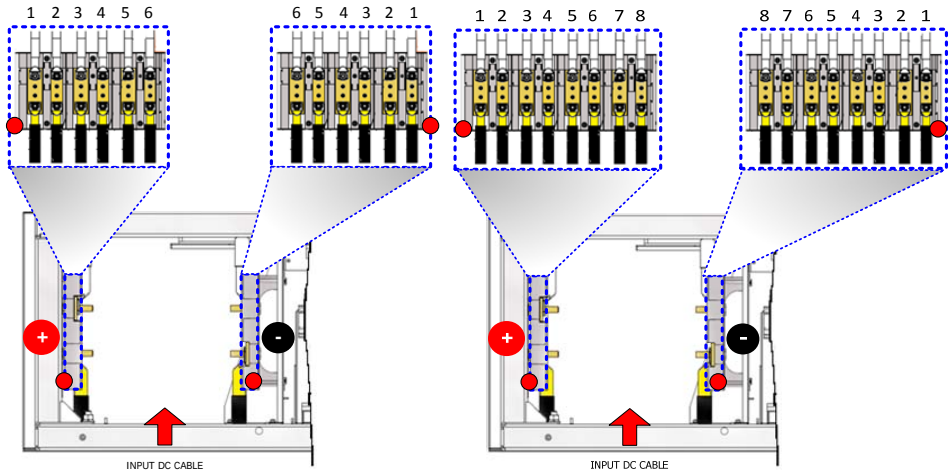


Figure 11-1: DC Cable connection (250/300kW and 350/400kW)

11.3. Connection of the protection earth cable (PE)

⚠ WARNING

For the safety of the system, the ground connection of the system must be sufficiently sized. The ground connection must be established before initial switch on of the system (Table 11-1 displays the minimum sections advised for use). The person or company in charge of the installation, in accordance with the prevailing code and regulations in force, is responsible for proper dimensioning of the ground conductor based on the characteristics of the inverter used and those of the system, in order to minimize the resistance of the ground connection. Connection must be made to the ground bar using a ground cable with grounding lug (Figure 11-2).

Model	Section	Lug
NEMA3R-250	4/0AWG	M 10
NEMA3R-300	4/0AWG	M 10
NEMA3R-350-TL	4/0AWG	M 10
NEMA3R-400-TL	4/0AWG	M 10

Table 11-1: Table of the minimum recommended dimensions for the grounding cables

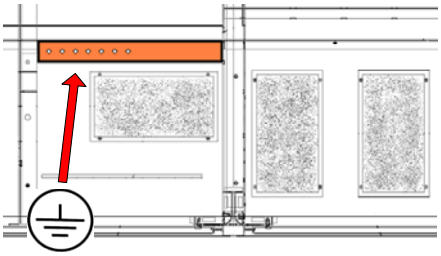


Figure 11-2: Connection of the protection Earth cable (PE)

11.4. Connection of the AC power cables

Remove, the front plastic cover protection placed in front of the bars, by means of the anchorage screws.
Connect the AC power cables as indicated in Figure 11-3 or Figure 11-4.

NOTICE

Respect the sequence of the phases indicated on the specific labels.

WARNING

It is important that the AC cables have an insulation rating of at least 600Vdc.

After the cable passage it is important to make sure that the open holes are closed, e.g. by means of expanded foam. This operation guarantees that no animals or dust can access the interior.

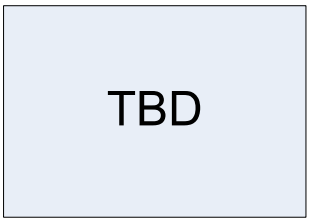


Figure 11-3: Connection of the AC power cables (versions ≥350kW without Transformer)

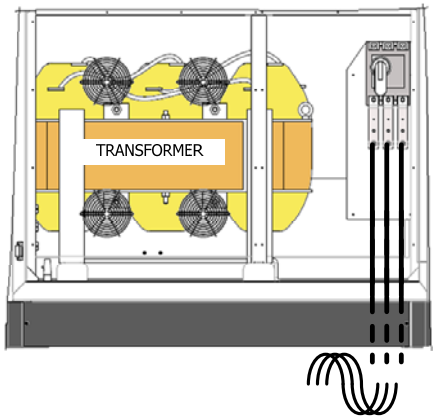


Figure 11-4: Connection of the AC power cables (versions ≤300kW with Transformer)

11.5. Connection of auxiliary energy supply

Auxiliary power supply for the inverter is obtained directly from the power grid via a direct internal connection. The absence of the power grid will therefore result in the inverter fully switching itself off.
The auxiliary power for all of the NEMA3R inverters is 3Ø, 3 wire + PE, at the same voltage level as the main AC grid connection, and can be fed internally from the main AC grid connection or via an external branch circuit as required.
If the auxiliary power supply needs to be fed from a separate external feed, follow these instructions:

- Disconnect the connected highlighted in Figure 11-5.
- Now remove this cable connected to the terminal board.
- Connect the cable (3P+T) to the terminal boards indicated in Figure 11-5**.**
- Leave the QS2 switch in the OFF position (down).

The QS2 switch has two functions:

- disconnect the auxiliary voltage
- disconnect the system in the case of breakdown of the OVR AC devices.

This switch is always accessible.

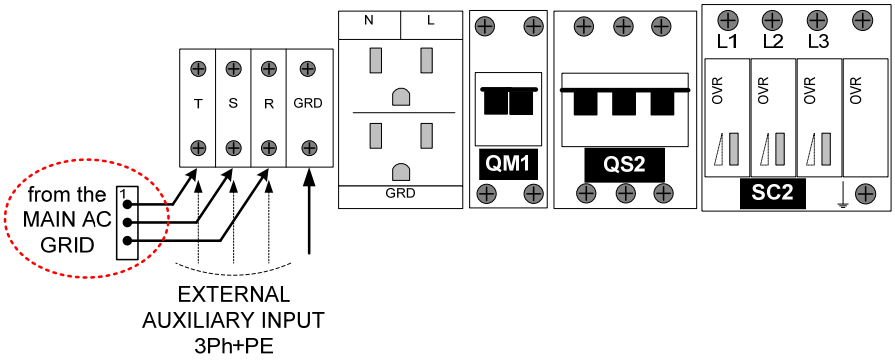


Figure 11-5: Wiring terminals for connecting the auxiliary AC grid feed and associated circuit breaker (QS2)

11.6. Connection of GROUND FAULT DETECTOR (GFD)

A ground fault is a condition that can affect operational safety and by regulation, when sensed, the inverter must be disconnected from the grid.

Aurora PVI-NEMA3R-XXX-US(-TL) inverters are equipped with ground fault detector (GFD) controls. The function of the GFD is to sense a ground fault current above a specific limit and cause disconnection of the inverter from the grid. This function is performed by a suitable fuse which blows at the required level, and the control monitors this condition and opens the main AC connection and provides a visual signal of the intervention via a red LED on the GFD module (Figure 5-4, Figure 11-6).

The 250/300kWp version can be connected to three distinct PV fields, and are therefore provisioned with three ground fault detectors.

The 350/400kWp versions contain a single GFD.

Chapter §17.1.3.1

The connection of this device is predetermined at the factory

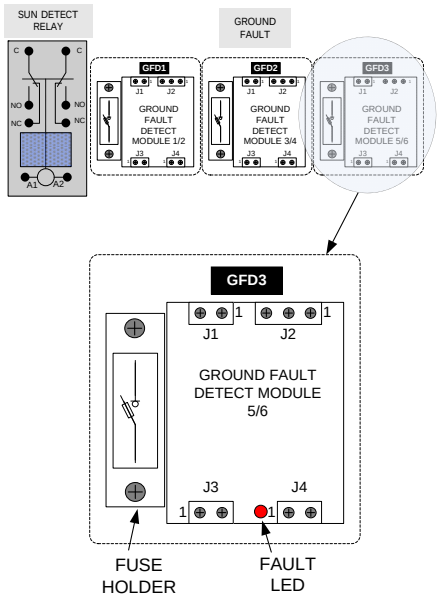


Figure 11-6: Three GFDs provisioned on the 250/300kWp versions

11.7. Connections for communications / state signals

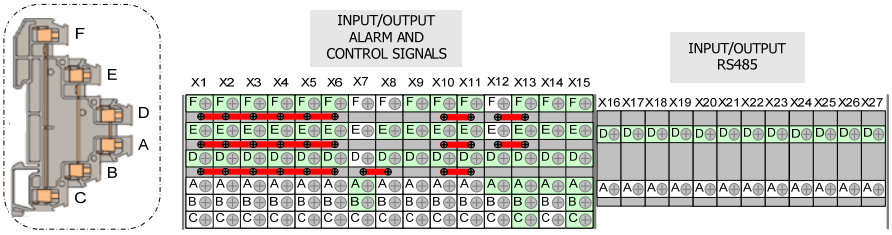


Figure 11-7: Internal terminal block ACBOX (F) area (for PVI-NEMA3R-250/300-US)

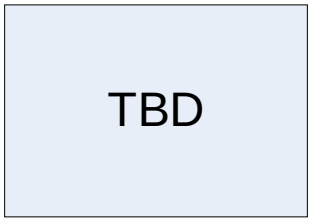


Figure 11-8: Internal terminal block ACBOX (F) area (for PVI-NEMA3R-350/400-US-TL)

To make any of the terminal block connections described in this section use a flat blade screwdriver sized to accommodate the clamp screws (with a tip of approx. 1/8th inch). To make connections, loosen the screw, insert the cable(s) and then tighten the screw to a maximum torque 70 in-oz).

Do not tighten the screws with force to a torque of more than 70 in-oz to avoid damaging the clamp.

Figure 11-7 and Figure 11-8 replicates the terminal block in the ACBOX area.

Chapter §5.2
Figure 5-11
Figure 5-13

The X16 and X27 clamps are dedicated to the RS-485 communication connection (Table 11-2).

Terminals from X1 to X6 are used to allow monitoring of the ON/OFF state of each of the 50kWp modules (Table 11-3).

Terminals X10 and X11 are connections for controlling the ON/OFF state of each 50kWp module via an external command (Table 11-4).

The left side of Figure 11-7 shows the internal construction of the terminal block. Note that for each column there are internal communications between rows C&F, B&E, and A&D.

The following tables show the signals present at various locations on the terminal board:

Table 11-2: Communication signals in the terminal block

X16		X17		X18		X19	
D	GRD_5V_ISO	D	+485_USR	D	-485_USR	D	GRD
A	GRD_5V_ISO	A	+485_USR	A	-485_USR	A	GRD

X24		X25		X26		X27	
D	GRD 7	D	+485_USR_2	D	-485_USR_2	D	GRD
A	GRD 7	A	+485_USR_2	A	-485_USR_2	A	GRD

Table 11-3: State signals in the terminal block

X1		X2		X3		X4		X5		X6	
F	-	F	-	F	-	F	-	F	-	F	-
E	-	E	-	E	-	E	-	E	-	E	-
D	-	D	-	D	-	D	-	D	-	D	-
A	AUX_C1	A	AUX_C2	A	AUX_C3	A	AUX_C4	A	AUX_C5	A	AUX_C6
B	AUX_NO1	B	AUX_NO2	B	AUX_NO3	B	AUX_NO4	B	AUX_NO5	B	AUX_NO6
C	AUX_NC1	C	AUX_NC2	C	AUX_NC3	C	AUX_NC4	C	AUX_NC5	C	AUX_NC6

Table 11-4: Control signals in the terminal block

X9		X10		X11	
F	GRD 7	F	REMOTE 5	F	REMOTE 6
E	GRD 7	E	REMOTE 3	E	REMOTE 4
D	GRD 7	D	REMOTE 1	D	REMOTE 2
A	GRD 7	A	REMOTE 1	A	REMOTE 2
B	GRD 7	B	REMOTE 3	B	REMOTE 4
C	GRD 7	C	REMOTE 5	C	REMOTE 6

NOTICE

For the terminals of Table 11-3 (module state) are dry contacts and can be used to externally monitor the ON/OFF state of each module. As such a low voltage (e.g. 12V or 24V) source can be connected but must be current limited to 1A or less.

11.7.1 Connection for the user RS485 serial communication

An RS-485 communication cable used for inverter monitoring is connected to the terminals shown in Table 11-2-2. See also Table Figure 11-7 and, for the position and names of the signals in the terminal block.

Chapter §8

Terminals from X16 to X19 and X24 to X27 are fully removable, facilitating the connection operation.

Figure 11-9: Removable clamp RS485

Connect the 485+ signal/s to the X17D clamp.
Connect the 485- signal/s to the X18D clamp.
Connect the return/s (RTN or earth) to the X16D clamp.
Connect the cable shield to the X19D terminal.
After every connection try pulling the cable to make sure that it is properly secured.
If PVI-NEMA3R-XXX-US(-TL) inverter isn't the last of the daisy chain, it is necessary to make sure that the 120 ohm termination resistor is disabled.

11.7.2 Setting the RS-485 120 ohm termination resistor

Each PVI-NEMA3R-XXX-US(-TL) inverter has a switch settable termination resistor for the RS-485 communication line. Each unit leaves the factory with the 120ohm termination disabled.

If multiple inverters are used in a system only the last rack in the daisy-chain connection should have its termination active. (Figure 8-1 and Figure 8-2), it is important that all other racks in the system have the termination resistor disabled.

The switch controlling the termination resistor is located beneath the main display (Figure 14-2).

11.7.3 Connection for the RS485 serial communication with PVI-STRINGCOMB-US

Each PVI-NEMA3R-XXX-US(-TL) inverter can manage up to 12 Aurora string combiner boxes (PVI-STRINGCOMB-US).
Follow the instructions of the PVI-STRINGCOMB-US manual, for the connection of the RS485 serial line.
Also see Figure 11-7 and Table 11-2, for the position and names of the signals in the terminal block.
Connect the 485_2+ signal to terminal X25D.
Connect the 485_2- signal to terminal 26D clamp.
Connect the return (RTN or earth) to the X24D.
Connect the screen/shield wire of the shielded cable to terminal X27D.
After every connection pull the cable gently to make sure that it is correctly secured.

The 120 ohm termination is already active within the inverter.

11.7.4 Setting the RS-485 communication addresses.

Place the QS2 switch into the ON (up) position. If the auxiliary line is live, all displays will be lit.
If the RS485 line is connected to more than one inverter PVI-NEMA3R, set a different address for each module via the front panel display of each connected 50kWp module.

Chapter §14

MAKE SURE THAT THERE ARE NO REPEATED RS485 ADDRESSES IN THE SYSTEM. THIS WILL CAUSE COMMUNICATION CONFLICTS.

11.7.5 Final checks.

Close the front panels of each chassis. For units with front panel AC switches, take care that the handle is positioned on 0 (OFF) and insert the connecting bar and tighten the panel screws.
After first reconnecting associated earth cables between the panels and the inverter chassis, close all the other panels,

12. POWER UP AND PLACING IN SERVICE

Before powering up the system, insure all connections have been made correctly and the system is in compliance with all safety requirements. In particular, make sure that all voltage values are within the set limits.

Chapter §0

12.1. Operating conditions

The following diagram is an illustration of the various functional phases of the inverter.

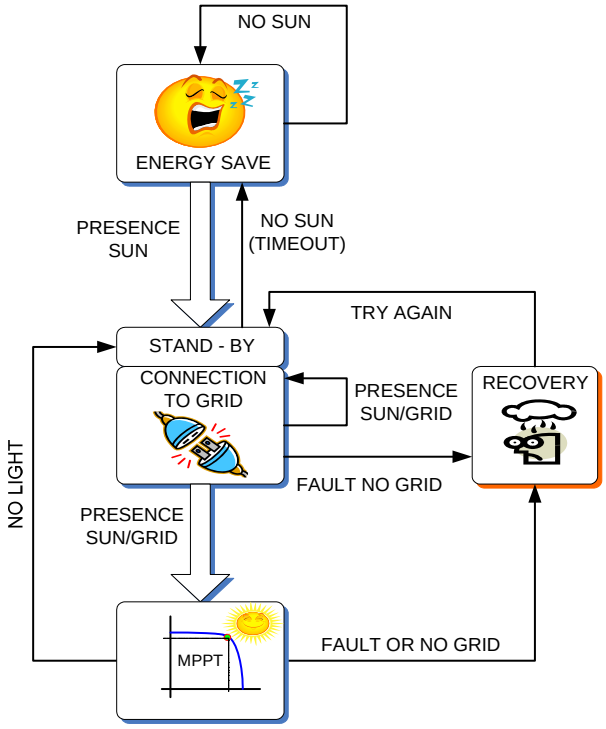


Figure 12-1: Inverter's operation diagram

12.2. Sequence for commissioning the Multi-Master/Slave systems

The procedure for starting up AURORA is as follows:

1. Make sure that the grid switch is OFF (0 or horizontal position).
2. Make sure that the DC switches are all OFF (0) per Figure 6-4 (A).
3. Place the QS2 switch in the ON position (up), to activate the system control. Note that the front displays should be active (lit).
4. Check the front signaling displays on each framework:

   Chapter §5.2.4

   a. In case of Multi-Master/Slave the MASTER LED will only light up on only one of the 50 kW modules of the Master/Slave group. The presence of two MASTER LEDs being lit in a master-Slave unit indicates a problem.
   b. In either case, the displays will show an alarm due to the open switches. The P/N of the System and the S/N of the modules will also be displayed cyclically.
   c. The POWER ON LED flashes.
   d. The ALARM LED is lit.
   e. The MISSING GRID LED is lit.
5. One at a time, close the DC switches by moving the handles to position 1 per Figure 6-4 (D):
   a. The display of the module with the closed switch will signal the alarm that the AC switch is still open.
   b. The POWER ON LED flashes red.
   c. The ALARM LED is lit.
   d. The MISSING GRID LED is lit.
   e. The main display will signal the presence of the open AC switch.
6. Close the cabinet doors and move the AC switch in position 1 (ON) by turning it clockwise:
   a. The open switch signal should disappear from the main (front door) display.
   b. The fans will be activated if the DC voltage is sufficient to leave the energy saving mode* (SE).

   In the energy saving mode, indicated by the display, the letters ***SE***, the system places itself in a monitoring-only condition and the ventilation system of the modules is deactivated)

   c. If the DC voltage is not sufficient to allow connection to the grid, the display presents a “WAITING FOR SUN” message. When the necessary conditions[1] (presence of DC and AC voltage) are satisfied, the system will automatically connect to the AC grid:
   - The Slaves are connected to the grid with the Master.
   - At each grid connection, the system will perform a complete scan of the PV field to locate the maximum power point. In this phase, power will suddenly peak and plummet for less than 5 seconds.

   d. The various key parameters will be shown on the main display.

   Chapter §14

1 The conditions for connection to the grid are determined by the country in which inverter is utilized.

12.3. Sequence for commissioning the 1Master/N.Slave systems

The procedure for commissioning a 1Master /N.Slave system is the following:

Chapter §6.2.2

TBD

13. OPERATION OF THE 50KWP MODULE INTERACTIVE DISPLAY

13.1. How the display functions

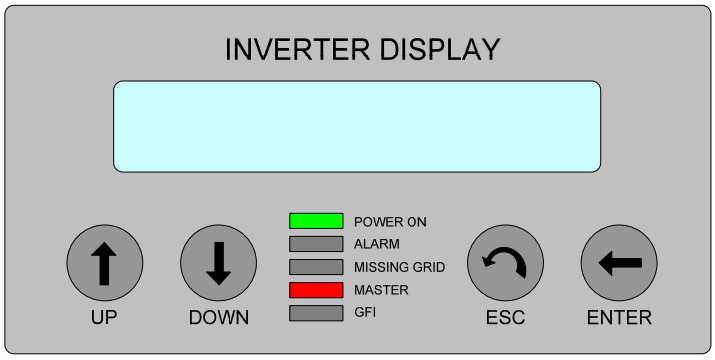


Figure 13-1: Display of the 50kWp module

The two-line LCD display (Figure 13-1) is located on the front panel of each 50kWp module and shows the following information:
The operational state of the inverter and statistical data.
Service messages for the operator.
Alarm messages.

During normal operation data is shown cyclically. By default the display updates every 5 seconds, or it can be controlled manually by pressing the **UP** or **DOWN** keys.
From any location in the program, to return to the preceding menu, press the ESC key.

Activation of cyclical scrolling is indicated by the two-arrow icon in the top left corner of the display.

Scrolling can be halted by pressing the **ENTER** key. The padlock icon will appear.

Cyclical arrows	
Padlock	

The display shows only 2 lines, therefore to view other items or gain access to sub- menus use the front panel **UP** and **DOWN** side keys.
When an item is selected, it will be highlighted by an arrow on the left side of the screen. Upon selection of the chosen, press the **ENTER** key to enter the associated sub-menu.

13.2. Password entry

If a password is requested, carry out the following procedure:

The default password is 0000. It can be modified via the Settings menu, per Figure 13-3.

Using the display keys, to enter the password digits:

- Pressing **ENTER** will scroll the cursor from one password digit position to the next, from left to right.
- Pressing **ESC** you return to the preceding number (from right to left).
- Pressing the ESC key several times will return the program to the previous menus.
- Pressing the **DOWN** key scrolls downwards through the digits (from 9 to 0) for the highlighted password digit position
- Pressing the **UP** key scrolls upwards through the digits (from 0 to 9) for the highlighted password digit position

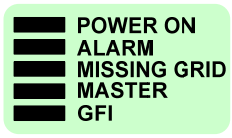
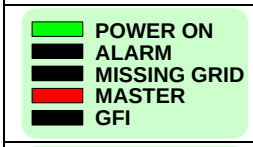
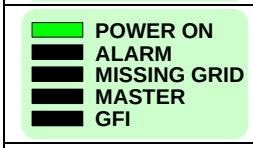
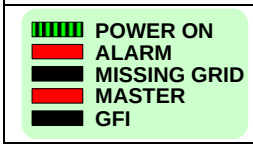
- After entering the correct password, press the **ENTER** key to access the various menu items saved within the password protected section.

13.3. The display LED

The display is provided with several signaling LEDS:
POWER ON: [GREEN LED] Indicates the presence of energy and of connection / disconnection from the grid.
ALARM: [RED LED] Indicates a problem.
GFI: [RED LED] Not used at present.
MISSING GRID: [RED LED] If lit, it indicates the lack of grid voltage at the inverter output. Lighting of this LED may also be due to the open grid switch (signaled on the display).
MASTER: [RED LED] Indicates whether the module is a Master (lit) or Slave (dark).

The following table shows the five configurations which can be indicated by the LED display during operation:

Table 13-1: Meaning of the display LEDs

STATE OF LEDs	MEANING
	All LEDS are off (dark). The module is not receiving power and all signals are absent.
	The module is connected to the grid. The module is Master.
	The module is connected to the grid. The module is Slave.
	The module is not connected to the grid. The module is Master. The AC grid is absent or out of range. The module is in an alarm state due to a problem in the grid.
	The module is not connected to the grid. The module is Master. The module is in alarm state due to a problem.

NOTE: In the table, the uniform color indicates the fixed LED on, while the alternating color indicates the LED is flashing.

13.4. Functional diagram of the display (Menu)

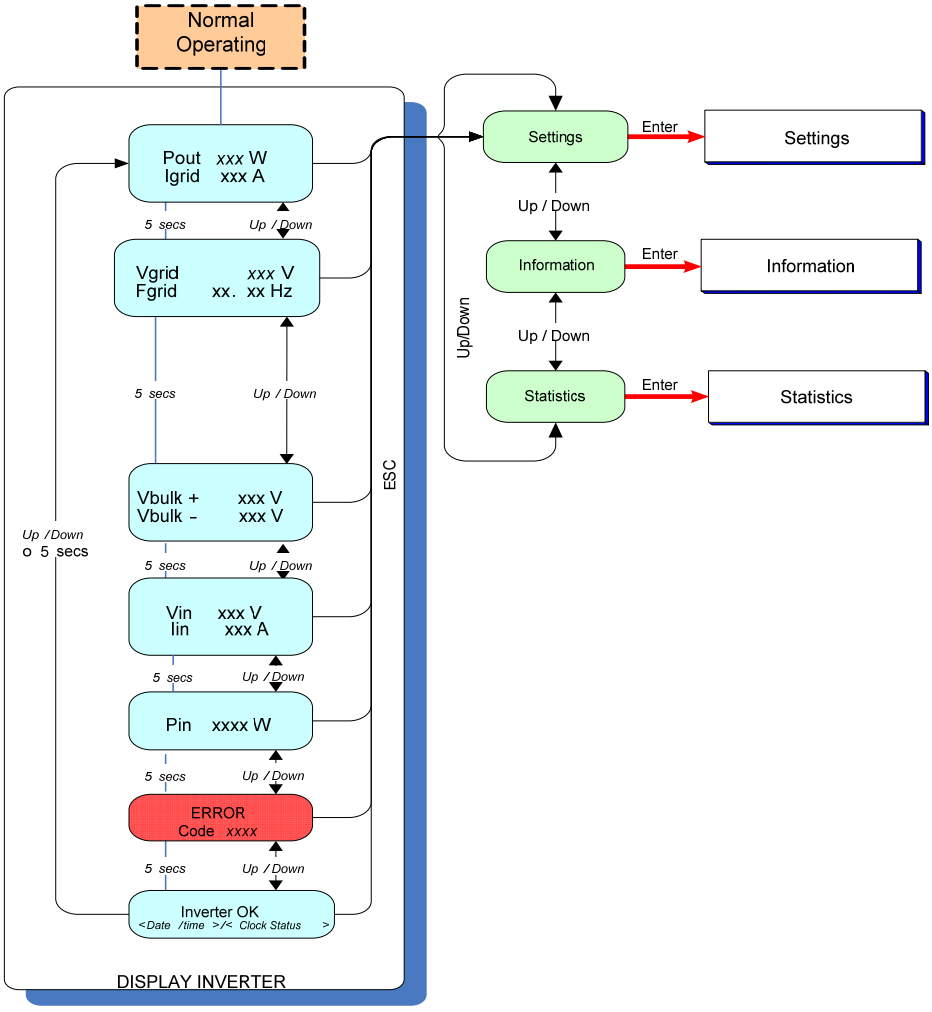


Figure 13-2: Functional diagram of the display (Main Menu)

The Figure 13-2 shows the information displayed during normal operation. Pressing **ENTER, ESC, UP or DOWN**, will cause the display to scroll among menus as indicated.

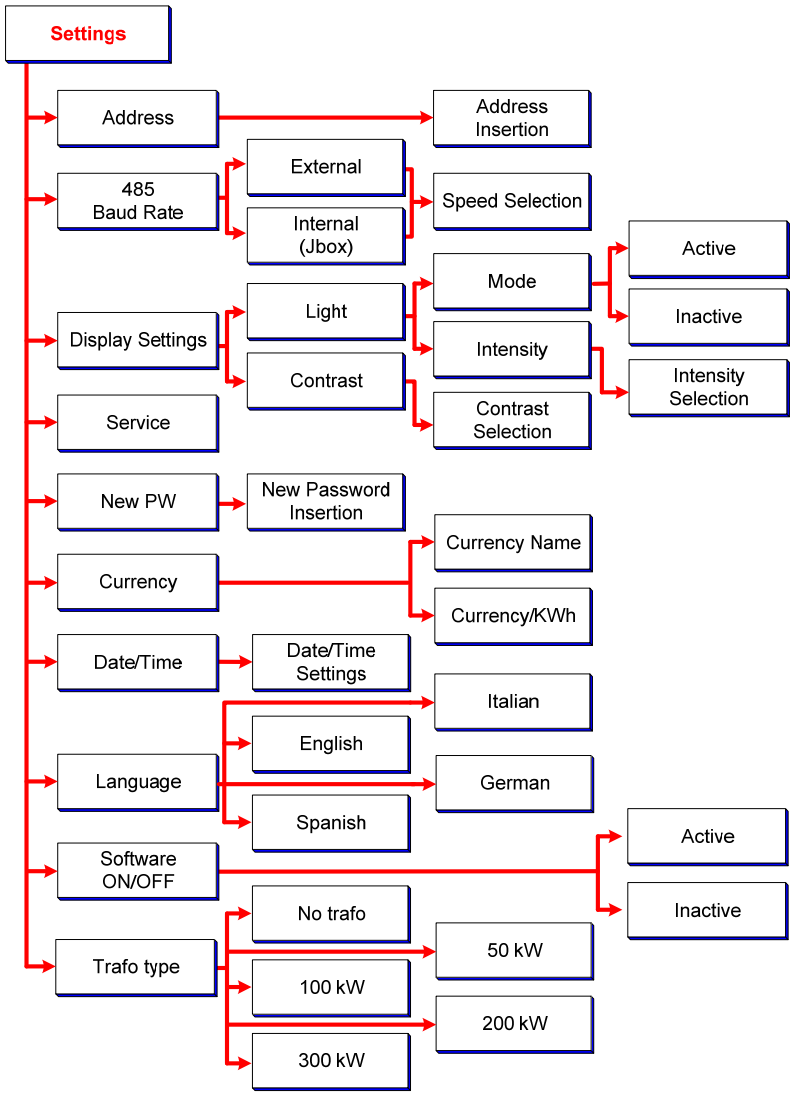


Figure 13-3: Functional diagram of the display (Setting menu)

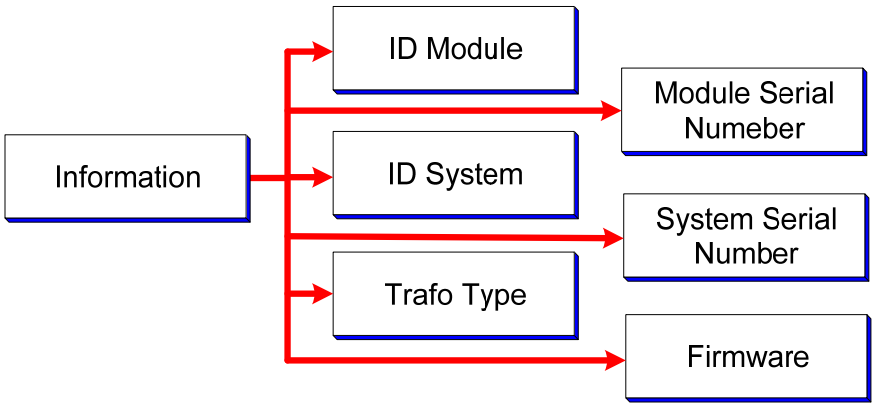


Figure 13-4: Functional diagram of the display (navigation of the Information menu)

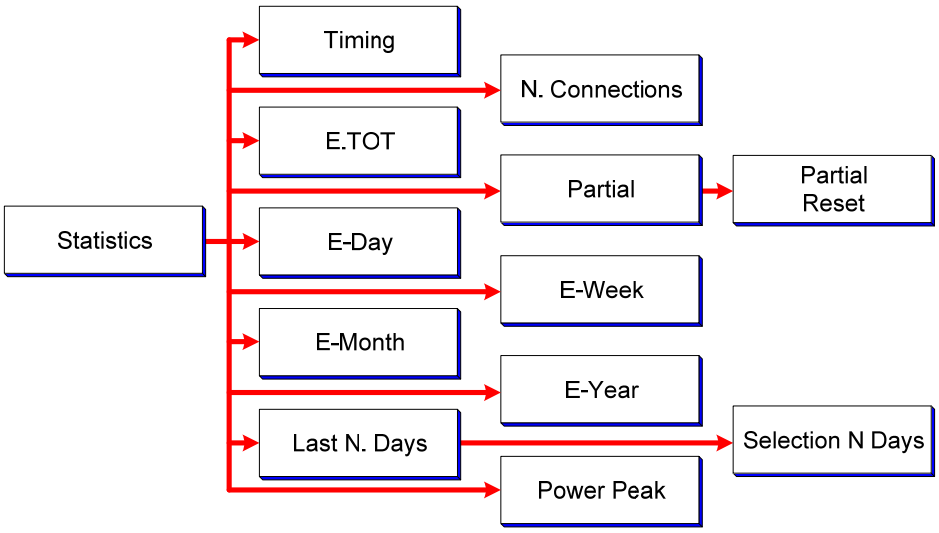


Figure 13-5: Functional diagram of the display (navigation of the Statistics menu)

13.5. Information Menu

By selecting the INFORMATION menu, the display will show the submenu shown in Figure 13-4.

13.5.1 ID. module

Selection of this item will display the Part Number of a selected module that is part of the system.

13.5.2 Mod. Series No.

Selection of this item will display "Mod.Series N." the following information will be shown:
Series No.: Series number of the selected module.
Wk xx Yr xx: Production week (Wk) and year (Yr) of the module.

13.5.3 System ID

Selection of this item will display four figures indicating the Part Number of the system.

13.5.4 Sys. Series No.

Selection of this item will display "Sys. Series No." the following information will be shown:
Series No.: Series number of the rack.

13.5.5 Trafo type

Selection of this item will display "Trafo type", the following information will be shown:
Trafo yes/no: Presence of the transformer or not.
Mod. No..: Number of modules in the system.

13.5.6 Firmware

Selection of this item will display the release version of the software in the module.

13.5.7 Junction Box (only on the module designated for control)

This item of the menu allows for verification of the state of any connected Aurora string combiner (StringCombs) boxes associated with the system.
Selection of this item will display "Junction Box", the following information will be shown:

Nn: is an assigned number, n, of a string combiner installed in the system (set by the installer)
Tn: is number n of the rack (Rack N.) to which the StringCombs is associated.
Rn: is number n of the StringCombs detected by the module. R must coincide with N, unless there is a fault.
Jn: is the ID number of a given string combiner. Number n varies from 1 to 12.
Px: indicates the presence (Y/N) of a PVI-STRINGCOMB-US string combiner. There can be a maximum of 12 in a system.

13.5.7.1 States

This menu allows an OK/NOT OK verification of the state of all parameters (listed below) within the previously selected StringCombs:

- **Fuses**: State of fuses.
- **Temp**: Temperature of the box.
- **Volt**: Voltage of the field.
- **Balance**: Unbalanced string currents.
- **Current**: String current.
- **Power**: StringComb supply.
- **Comm**.: Communication.
- **Cal**: Current calibration.

13.5.7.2 Fuses

Selection of this item allows verification of the state of the single fuse.

es of the StringComb selected previously. The result can be OK or NOT OK:

- **F1**: State of fuse F1.
- ….
- **F20**: State of fuse F20.

13.5.7.3 Currents

Selection of this item allows verification of the state of the currents of the StringComb selected previously. These can be OK or NOT OK:

- **I1**: State of current I1.
- ….
- **I20**: State of current I20.

13.6. Statistics

Selecting the STATISTICS menu, will display the submenu shown in Figure 13-5.

13.6.1 Timing

Selection of this item will display the following information:
Life: Total operating time.
Grid: Hours of connection to the grid.

13.6.2 N. Conn (Number of Connections)

Selection of this item will display the number of connections with the grid.

13.6.3 E-Tot

Selection of this item will display the following information:
E: Total energy produced.
Val.: Economic gain.

13.6.4 Partial

Selection of this item will display the following information:
PT: Total operating time since the last time the count was reset.
E: Total energy produced since the last time the count was reset.
Val.: Economic gain since the last time the count was reset.
Partial Reset: Allows reset of the preceding parameters to zero.

13.6.5 E-today

Selection of this item will display the following information:
E: Total energy produced today.
Val.: Economic gain today.

13.6.6 E-Week

Selection of this item will display the following information:
E: Total energy produced this week.
Val.: Economic gain this week.

13.6.7 E-Month

Selection of this item will display the following information:
E: Total energy produced this month.
Val.: Economic gain this month.

13.6.8 E-Year

Selection of this item will display the following information:
E: Total energy produced this year.
Val.: Economic gain this year.

13.6.9 Last N Days

Selection of this item will display the following information:
E: Total energy produced in the last days indicated by N.
Val.: Economic gain in the last days indicated by N.

13.6.10 Power Peak

Selection of this item will display the following information:
PPA: Value of the power peak measured at system turn-on.
PPT: Value of measured peak for today.

14. AURORA CENTRAL PVI MONITOR

14.1. How the display functions

Figure 14-1: Display touch screen of the NEMA3R

The main system display shown in Figure 14-1 is located in the left door of the front panel of PVI-NEMA3R-XXX-US(-TL). It is possible using this display to view parameters for up to eight 50kWp modules concurrently, and using the touch screen functionality, to view the following information:
Operational status of all 50 kW modules of the inverter and static data.
Operational status of all PVI-STRINGCOMB-US connected to the inverter.
Service messages for the operator.
Alarm messages.

The display can also communicate with other devices (e.g. a normal laptop computer) by means of a Type B USB port and, as an option, via Bluetooth; this type of communication is made possible by the use of a special software.
The graphic display allows a simple and intuitive interface for the operator, capable of navigating through the various menus using the touch-screen feature.

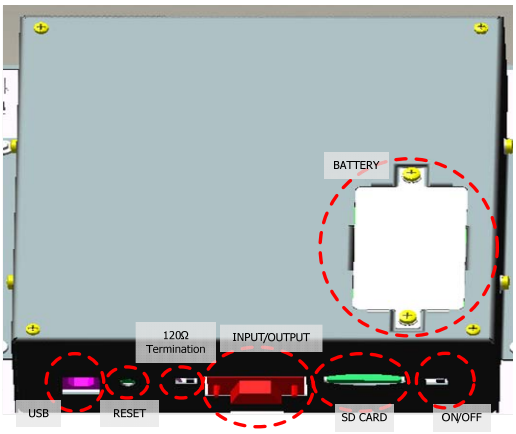


Figure 14-2: Interactive display

The bottom rear edge of the display, can be accessed by opening the left door of the PVI-NEMA3R-XXX-US(-TL), and contains the following items:
a type B USB port for connection to a personal computer,
an SD card to save system data (indispensable for display operation)
the ON/OFF switch,
a reset button,
the supply and communication connector RS485
and a switch to configure RS485 termination (user side).
Battery compartment. Remove the screws to access the CR2032 lithium clock battery, and a selector for the configuration of termination RS485 (Figure 14-2).

14.2. Front status LED signaling

The front of the display has a multicolor status LED. This LED changes color according to the status of Aurora Central PVI Monitor. The indication of various operation status and their corresponding colors are:
LED OFF: No power supply connected.
GREEN LED: Low battery; at least one power supply connected (DC or USB).
ORANGE LED: Battery is charging.
RED LED: Low battery; no power supply connected (DC or USB).
BLUE FLASHING LED: Aurora Central PVI Monitor in stand-by.

14.3. Default screen

The default screen of Aurora Central PVI Monitor is an intuitive screen that summarizes the important data of the system and its operation status. (See Figure 14-3).

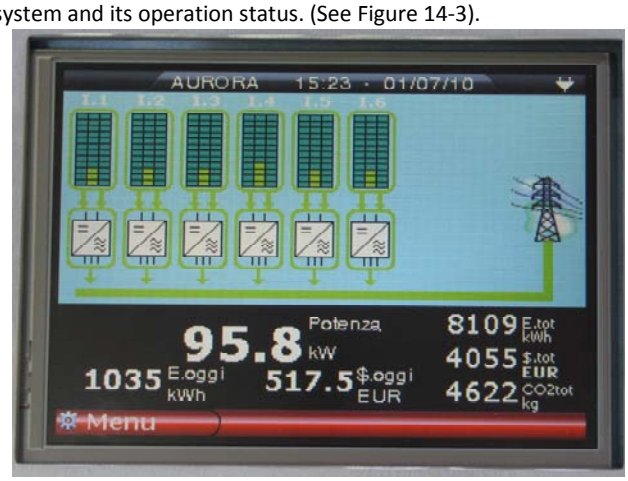


Figure 14-3: Default screen

The tool bar at the top of the screen contains the following information:

- Date and time.
- Mains or battery power supply.
- Battery level.
- The colored, central part of the display shows the 50 kW modules (as icons) present in the monitored system. Each 50 kW module contained in the device is surrounded by a line. The color of this line indicates the status:
  - Green line: Inverter connected and operating correctly.
  - Yellow line: Inverter on but not yet connected to the power grid.
  - Red line: Inverter in alarm.
  - Blue line: Inverter off.

Clicking on one of the icons for the 50 kW modules will open a balloon containing the identification data of the single module and its operation status. (Figure 14-4)

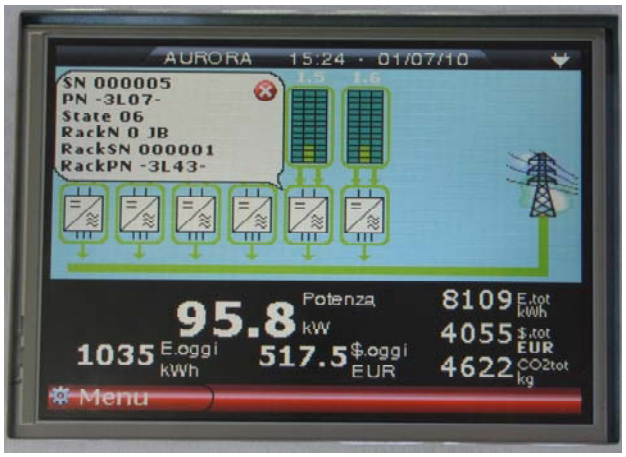


Figure 14-4: 50 kW modules information

The black central part of the screen provides a summary of system data, i.e. generated instantaneous power, power produced today, money saved, total power produced by the system since installation, money saved overall, and reduction of carbon dioxide.
Clicking any point within the black section displays detailed information about the system. (Figure 14-5)

Figure 14-5: General information on the device

The screen of Figure 14-5 displays a graph of the power produced by the system throughout the course of the day and, by clicking on the appropriate tab, per each single inverter. In addition, the left side shows a summary of sensitive parameters. The central black section and the bar at the top show the same information as in the default screen.
Clicking on the tabs to select graphs and data associated with each inverter or to the system as a whole. The tabs also show permanently visible information about the status of the modules and a power meter that indicates the power exported in a graph.
The red area at the bottom contains the Menu button to access the menu.

14.4. Mains menus

From either of the previous screens, click on the Menu button to access the main menu screen.
The menu of Aurora Central PVI Monitor is divided in several sections, and each section has its own submenus for displaying, setting or altering the configurations of the object.

14.4.1 Statistic menu

From this section (Figure 14-6) it is possible to display all production data related to the system for certain intervals of time. The subsections indicate the interval of time for which it is desired to display production figures (Total, Partial, Today, 7 Days, 30 Days, 365 days, or set by the user).

Figure 14-6: Statistic menu

14.4.2 Settings menu

In this section (Figure 14-7) changes to the configuration parameters can be made.

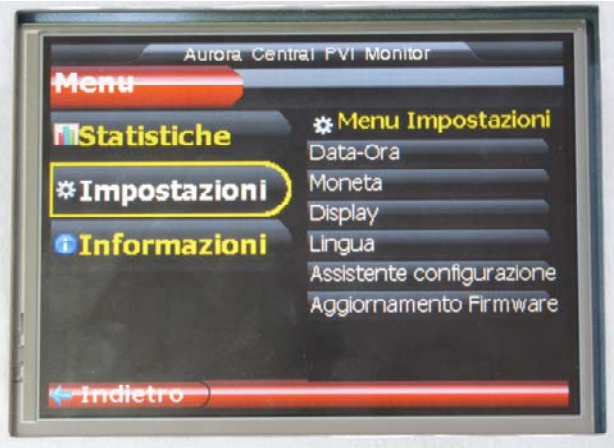


Figure 14-7: Settings menu

Item	Description
Date-Time:	allows change to the date and time.
Currency:	allows insertion of the local currency to calculate energy saving/earnings.
Display:	allows setting the backlight over a 0 to 9 scale and recalibrates the touch screen
Language:	changes the system language
Settings assistance	opens a guided procedure to allow reconfiguring1 of the communication channel.
Firmware updates:	starts a procedure to update the firmware of Aurora Central PVI Monitor in order to obtain the latest version released.

Chapter §14.5

1 The configuration is done at the factory.

14.4.3 Information menu

The subsections of this menu provide information about the serial number of Aurora Central PVI Monitor, the serial numbers of all inverters connected to the system and the firmware version installed.

Figure 14-8: Information menu

14.5. Firmware update

The Aurora Central PVI Monitor is updated often and it might be necessary to update it periodically so that new functions can be implemented. The update requires a very simple procedure, described below:

In order to take the steps described below it is necessary to have basic knowledge regarding the creation of directories and renaming of files on Windows OS.

- The first step for the update is checking that the latest firmware is available. This can be done by connecting to www.power-one.com.
- In order to update Aurora Central PVI Monitor, it is necessary to extract the SD card (press it lightly to remove it) and insert it in a reader connected to the PC. At this point, follow the instructions below:

1. Check whether the SD card is formatted by right-clicking on it and selecting “Properties”. Make sure formatting is FAT and not FAT32.
2. Open the SD card, which will contain several folders (language, theme etc), including the BOOT folder. If it is not present, create it.
3. Copy the file you downloaded from the Power-One website into the BOOT folder and rename it as “boot.ben”.
4. Remove the SD card from the computer using the safe hardware removal procedure and insert it in Aurora Central PVI Monitor again.
5. Navigate through the menu until you find the firmware update section.
6. Click on Next: Aurora Central PVI Monitor will start the update procedure.
7. Once the new software has been read and loaded, the display will prompt for a selection; from this screen decide whether to install the new firmware, return to the previous version or cancel the procedure and maintain the current firmware.
8. Wait until Aurora Central PVI Monitor finishes the installation operations. Once the installation process has concluded, the default screen will automatically be displayed.

15. BEFORE USING THE SOFTWARE

The software produced for the PVI-NEMA3R-XXX-US(-TL) allows setting the transmission parameters (e.g. baud rate) and for control (e.g. power limit) and for monitoring the electrical dimensions (e.g. values of the phase voltages).
To be able to communicate with PVI-NEMA3R-XXX-US(-TL), the computer used must have a free COM serial port.

Since, as already described, the serial transmission standard of the PVI-NEMA3R-XXX-US(-TL) is the RS485, while the COM port of the computer is used on the RS232 standard, **an Aurora RS232/485 adapter must be used** (Aurora 232/485 Converter).

Chapter §8

15.1. Software installation

NOTICE

Place the CD provided with the PVI-NEMA3R-XXX-US(-TL) into the computer and launch the “setup.exe” program, then follow the instructions on the screen.

In conclusion, the icon “Aurora CENTRAL CVI” will appear on the computer Desktop[1] and in the position:
Start →
Programs→
Aurora CENTRAL CVI

The next chapter shows how to use the PVI-NEMA3R-XXX-US(-TL) configuration and monitoring program.

1 Future software versions could have a different icon.

16. MONITORING AND CONFIGURATION INTERFACE

16.1. Conventions used

In this chapter the following conventions are used in the text:
[**BUTTON**]: Indicates a button
(*selection list*): Indicates a list for selection.
Menu name: Indicates the name of a menu. window name.

16.1.1 Rack and Modules

Hereinafter, the single 50kWp boxes will be indicated with "**Modules**".
The name "**Rack**" indicates a system composed of several modules. Each Rack can have up to 6 Modules.

In this manual the name Tower or Rack have the same meaning.

16.2. Access levels

The software allows for two access level:
Standard (User): allows access only to monitoring functions. Some screens of the program have hidden and/or limited functions.
Advanced (Technical): allows access to monitoring and other technical functions. All program functions are enabled except for some areas which are used exclusively by the factory.

The password for advanced access is "aurora"[1].

[1] The password cannot be changed; always use lower case.

16.3. Diagram of the monitoring software

The “software map” of Figure 16-1, provides a layout of the program structure of the monitoring program. The following paragraphs will describe in detail the individual blocks of the diagram.

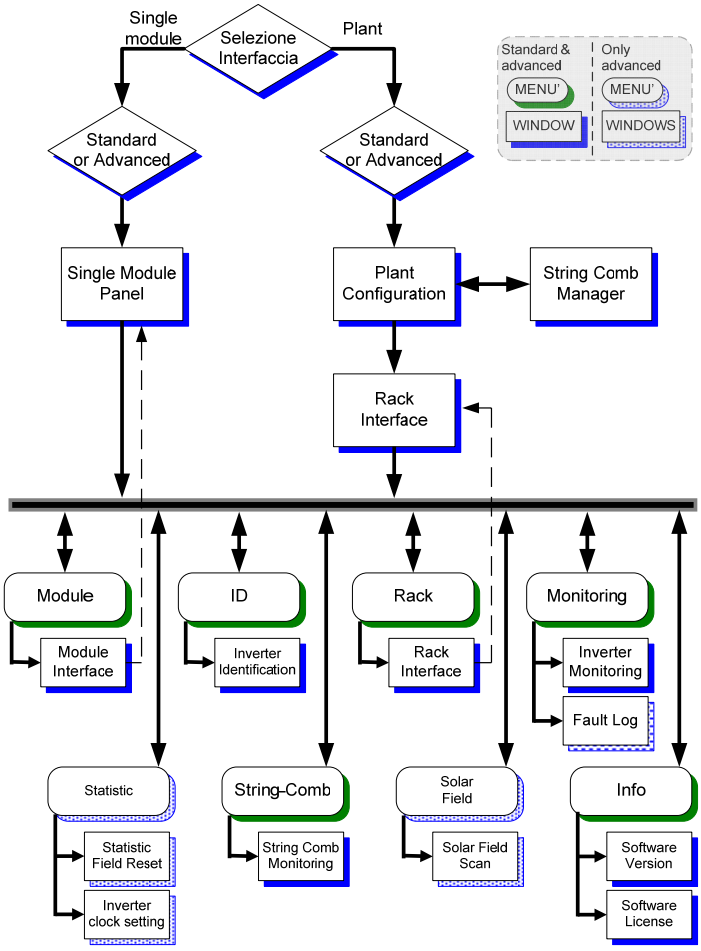


Figure 16-1: Software Map of Monitoring Functions

16.4. Use of the monitoring program

Double click on the “Aurora Central CVI” icon and wait for the COM settings screen of Figure 16-2 to appear (after processing screen):

Figure 16-2: COM Settings screen

Enter the correct COM port number to which the RS485/232 adapter is connected into the (*PC COM Ports*). field
Enter the communication speed into the (COM Baud-Rate) field.
Press the [**COM SET**] button to open the screen of Figure 16-3.

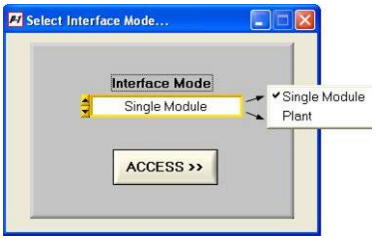
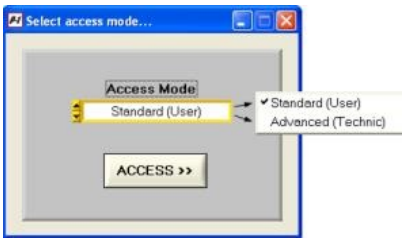


Figure 16-3: Choice of the interface type

Choose the desired path by picking one of two options for (*Interface Mode*):

- *Single Module*: all modules connected to the RS485 line are displayed.
- *Plant*: all racks connected to the RS485 line are displayed.



Select access mode , either standard or advanced as desired, and press the [**ACCESS >>**] button in the above screen to open the screen of Figure 16-4:

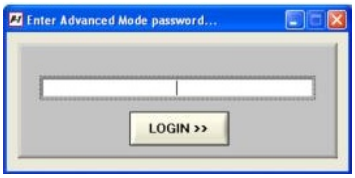


Figure 16-4: Advanced Mode Login

If the “advanced” mode is chosen, it is necessary to insert the password “aurora”. In "standard" mode, some menus will be disabled.

Depending upon the mode choice made in Figure 16-3, either the *Single Module Panel* or *Plant Configuration* window will appear.

Chapter §16.4.2

16.4.1 Single Module Panel

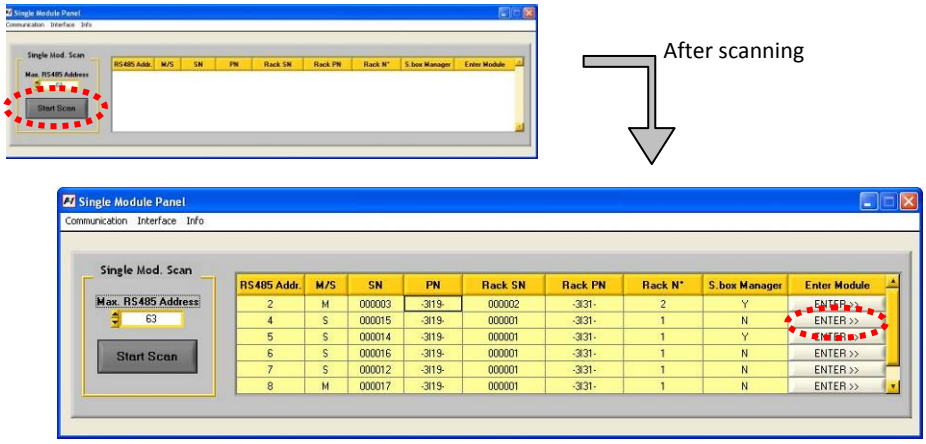


Figure 16-5: Single Module Panel

- In the upper screen of Figure 16-5, in order to reduce scan time, the user can set a limit based on highest RS485 address used by populating the (Max RS485 Address) field. Doing so the program will scan to find all the modules within the chosen address range.
- In the lower screen of Figure 16-5, click on the [**Start Scan**] button, and the system will search for all the connected and functioning modules within the chosen range.
- The window shows a summary table of all models found. The parameters indicated in the columns are as follows:

- **RS485 Addr**.: RS-485 address assigned to the module.
- **M/S**: M=Master, S=Slave
- **SN**: Series number of the Module
- **PN**: Module code
- **Rack SN**: Series number of the Rack to which the module belongs
- **Rack PN**: Code of the Rack to which the module belongs
- **Rack No.**: ID number of the Rack
- **S.Box Manager**: Indicates whether the module is used for management of data associated with any connected AURORA string combiners (PVI-STRINGCOMB-US).
- By pressing the corresponding [**ENTER >>**] button associated with a given row, access is gained to the management functions of the selected module (Figure 16-9)

16.4.2 Plant Configuration

When initially displayed, the screen shown in the left side of **Error! Reference source not found.** will be empty, because the program must first scan to determine how the plant configuration

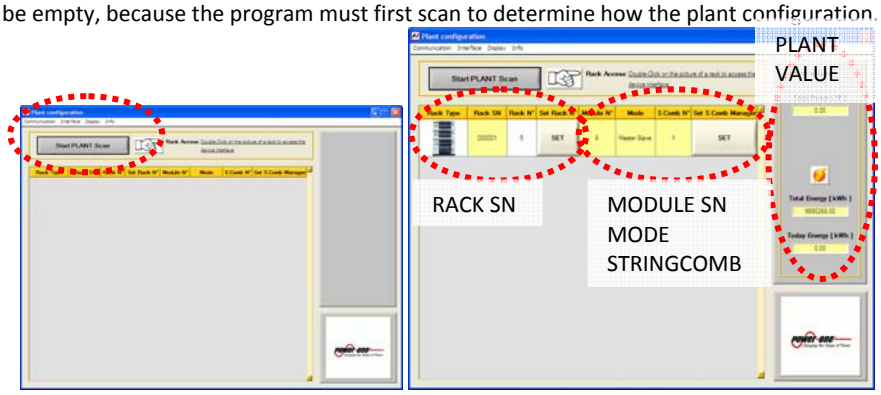


Figure 16-6: Plant Configuration

To initiate a scan, click on the [**Start PLANT Scan**] button, and the system will search and list all connected and functioning Racks.

The right screen of **Error! Reference source not found.** can be segregated into several areas providing the following information:

- **Plant value**: This area of the screen displays the instantaneous power output (W), the daily energy and the total energy produced (kWh).
- **Rack SN**: The rack serial number and identity number (Rack No.), the latter being assigned to the rack and to all the modules to identify the whole tower. The rack number can be changed by entering a new number using the [**Set Rack Number**] button.
- **Module N°/Mode/StringComb:** The number of modules contained in the rack (Module No.), operating mode (Mode) and the number of connected string-boxes (S.Comb N.)[1].
- By pressing the [**Set S.Comb Manager**] button the menu shown in Figure 16-6 can be accessed, and by pressing the [**SELECT>>**] button the management and monitoring of the chosen PVI-STRINGCOMB-US is assigned to the corresponding module.

It is preferable to assign the string-box management to a 50kW slave module, if present, instead of the master.

[1] Before assigning the stringcomb manager, it is necessary to configure the RS485 line of the string boxes by means of the stringcomb software installer (see stringcomb manual).

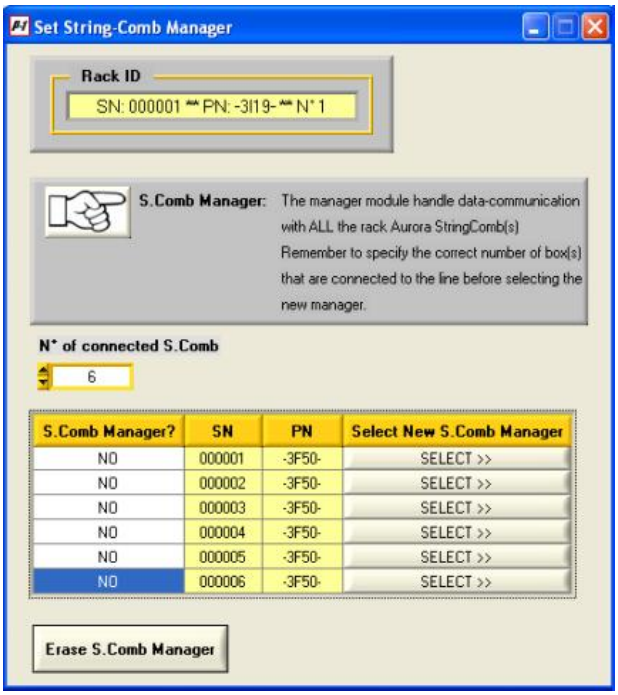


Figure 16-7: Choice of the StringComb Manager

By double-clicking on the tower icon in **Error! Reference source not found.**, the Rack Management menu (Figure 16-9) can be accessed, from which, it is possible to control and/or identify an alarm, and gain access to a single module.

From the Display menu of Figure 16-6, it is possible to open a system monitoring screen (Figure 16-8) from which a very useful small monitoring system can be configured.

The LOGO, images and system information on this page can be all customized.

Figure 16-8: Display of Solar monitoring

16.4.3 Rack Interface

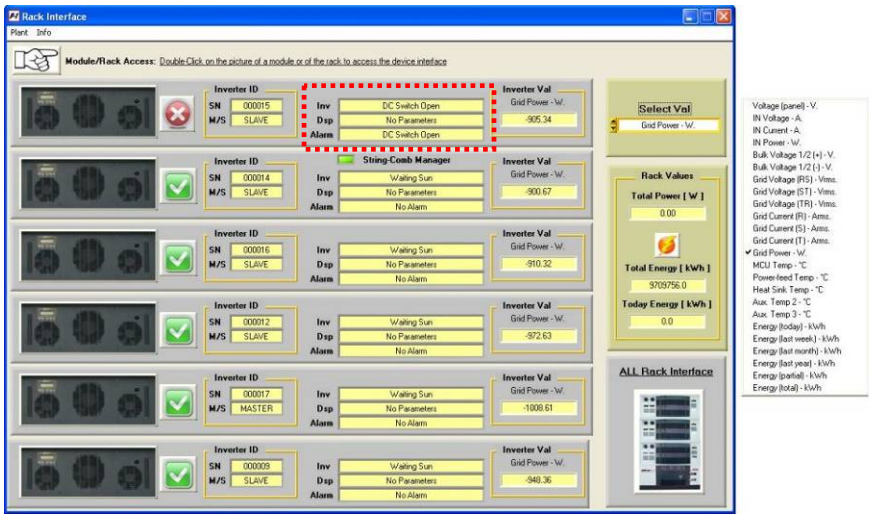


Figure 16-9: Rack Interface – Rack Management

In the Rack Interface mode, the main parameters and the state of every module of the system can be observed (refer to Figure 16-9):

The symbol indicates a module is operational, while the symbol identifies a module in an alarm mode.

In the area indicated by the dotted line, the state of the Supervisor (Inv), of the digital signal processor (DSP) and of the type of alarm (Alarm) can be read.

- **Inverter ID:** shows the serial number (SN) and the state of the master or slave of the module (M/S).
- **Inverter Val**: shows the value of the size selected from the list (*Select Val)*, in the top right side.(Figure 16-9) shows the list of addressable items where the following values can be seen:
- **Voltage [Panel]**: Voltage read by the supervisor [Vrms]
- **IN Voltage**: Field voltage [Vrms]
- **IN Current**: DC input current [Arms]
- **IN Power**: Input power [W]
- **Bulk Voltage ½ (+)**: DC voltage on the internal capacities + [Vdc]
- **Bulk Voltage ½ (-)**: DC voltage on the internal capacities - [Vdc]
- **Grid Voltage (RS)**: Grid voltage linked to phases R-S [Vrms]
- **Grid Voltage (ST)**: Grid voltage linked to phases S-T [Vrms]
- **Grid Voltage (TR)**: Grid voltage linked to phases T-R [Vrms]
- **Grid Power (W)**: Power sent to the grid
- **MCU Temp**: Supervisor temperature [°C]
- **Power Feed Temp**: Internal power supplier temperature [°C]
- **Heatsink Temp**: Power electronics heatsink temperature [°C]

- **Aux Temp 2**: N/A (this indicator is not used)
- **Aux Temp 3**: Framework environment ambient temp. sensor [°C]
- **Energy (today)**: Energy produced today [kWh]
- **Energy (last week)**: Energy produced last week [kWh]
- **Energy (last month)**: Energy produced last month [kWh]
- **Energy (last year)**: Energy produced last year [kWh]
- **Energy (partial)**: Energy produced since the last re-setting [kWh]
- **Energy (total)**: Total energy produced until today [kWh]

Double clicking on the icon of the single module will access the management menu of the single module (Figure 16-10).
Double clicking on the icon of the rack, will return the display to the rack interface menu (Figure 16-9).

The management menu of the single module (Figure 16-5) can be accessed as indicated above or, alternatively, by choosing "single module" in Figure 16-3 and pressing the [**ENTER>>**] button of the *Single Module Panel* window.

16.4.4 Menus bar

From the standard or advanced mode, the user may access the following menus:

Menus in Standard mode

Module	→	Module interface[1]
Rack	→	Rack interface[2]
ID	→	Inverter Identification.
Monitoring	→	Inverter Monitoring.
String-Comb	→	StringComb monitor.[3]
Info	→	Software version.
	→	Software license.

Menus in Advanced mode

Module	→	Module interface[1]
Rack	→	Rack interface[2]
ID	→	Inverter Identification.
Monitoring	→	Inverter Monitoring.
	→	Fault Log.
Statistic	→	Statistic field - reset.
	→	Inverter clock settings.
String-Comb	→	StringComb monitor.[3]
Solar field	→	Solar field scan.
Info	→	Software version.
	→	Software license.

Module interface and Rack interface show the associated windows illustrated in paragraphs.

Chapter §16.4.1
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The functions (screens) available via these menus are explained in detail below.

[1] active in single module mode
[2] active in single plant mode
[3] active only on modules dedicated to StringComb management

16.4.5 Inverter Identification

The screen of Figure 16-10summarizes the nameplate data of a single module:

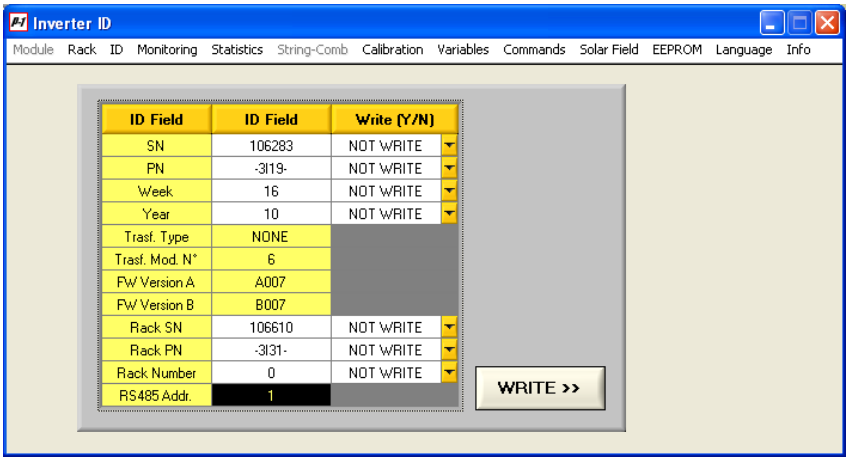


Figure 16-10: Inverter ID – Single Module Interface

The parameters listed are as follows:

Item	Description
SN:	Series number of the module
PN:	Part number of the module
Week:	Week of production
Year:	Year of production
Transf. Type:	Type of connected transformer
Transf. Mod. No.:	Number of modules connected to the rack
FW Version A:	DSP firmware revision
FW Version B:	Supervisor firmware revision
Rack SN:	Series number of the rack
Rack PN:	Part number of the rack
Rack Number:	Identification number
RS485 Addr.:	RS485 Address of the rack in the plant

16.4.6 Inverter Monitoring

The screen of Figure 16-11 allows monitoring a single module at the rack level.

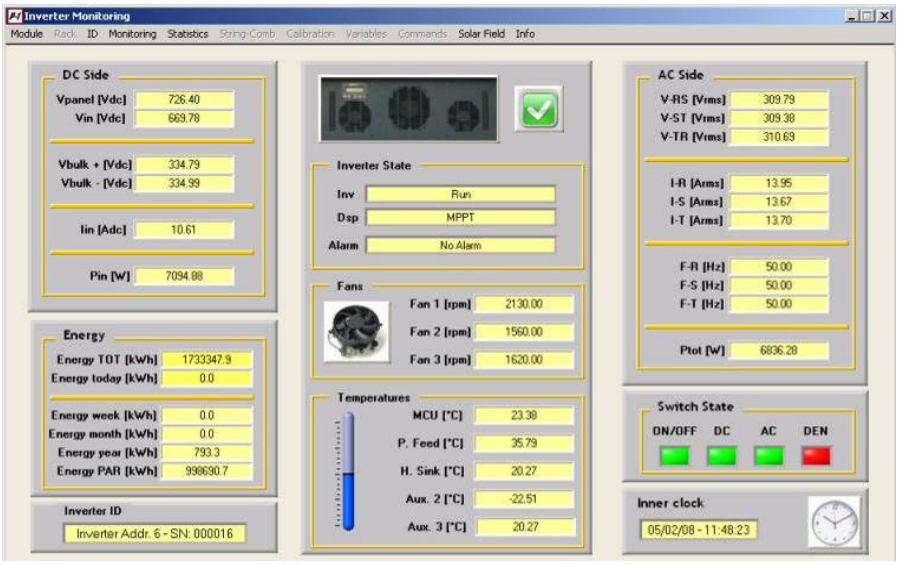


Figure 16-11: Inverter Monitoring

Area	Description of items
DC Side:	the DC electrical parameters are presented.
Energy:	the total and partial energy of the module is presented.
Inverter State:	the state of the inverter
Fans:	shows the rotation speed of the module fans.
Temperatures:	shows the temperature of the microprocessor (MCU), of the power supplier (P.Feed), of the dissipater (H.sink) and of the framework (Aux. 3). The Aux2 indication is not used.
AC Side:	indicates the voltages, currents, frequency of the three phase triad and the power exported from the module.
Switch state:	indicates state of switches on inverter closed switches are indicated in green, and open switches in red. • ON/OFF: Remote ON/OFF • DC: DC switch position • AC: AC switch position • SPD: Indication of the OVR DC state.

16.4.7 Rack Monitoring

This screen of Figure 16-12 allows monitoring of all modules that are part of the rack.

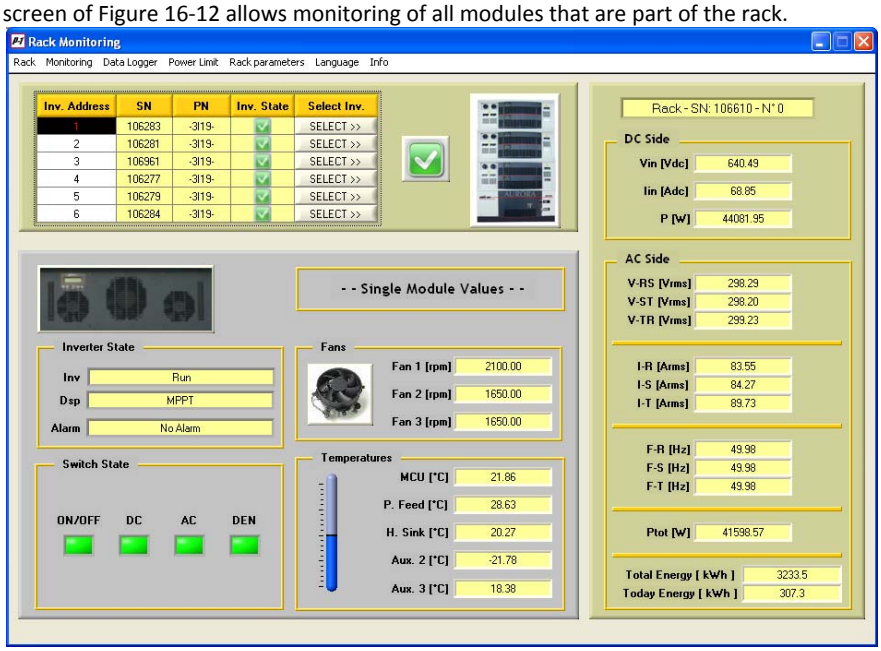


Figure 16-12: Rack Monitoring

- **DC Side**: in this area, the DC electrical parameters are presented.
- **AC Side**: indicates the voltages, currents, frequency of the three phase triad and the power exported from the module.
- **Energy**: shows the total and partial energy of the module.
- **Select**: offers the possibility to choose the module to be displayed and that is part of the rack.
- **Single Module Values**: the state of the selected inverter.
- **Fans**: shows the rotation speed of the module fans.
- **Temperatures**: shows the temperatures as in the Inverter Monitoring.
- **Switch state**: closed switches are indicated in green, and open switches in red as in Inverter Monitoring.

16.4.8 Fault Log

The screen of Figure 16-13lists the faults and alarms registered by a selected module:

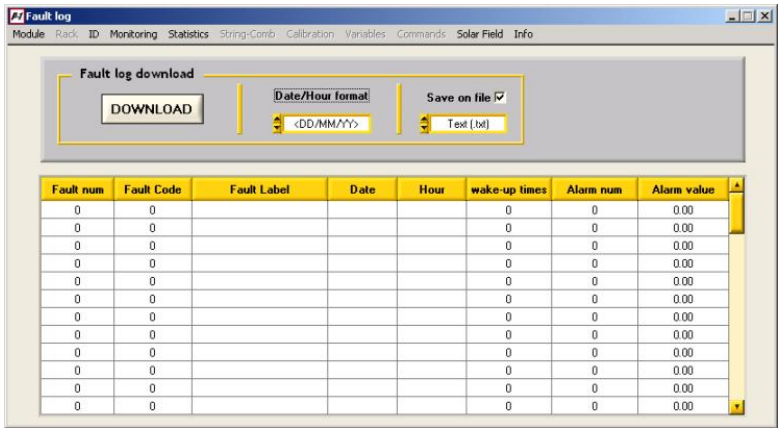


Figure 16-13: Unpopulated Fault log screen

- The (*Date/Hour format*) box allows specification of a format for the date field associated with the data will be displayed.
- The (*Save on file*) box, if enabled, allows the fault list to be saved in either a text (.txt) format or an excel (.xls) format, based on the choice made.
- By pressing the [**DOWNLOAD**] button, the system downloads the faults from the inverter, and after displaying a processing window then lists the downloaded faults (Figure 16-15). Afterwards, a prompt screen window will appear asking whether to save the data to as a data file (Figure 16-14).

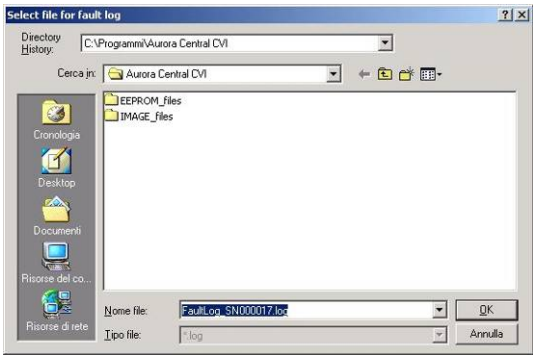


Figure 16-14: Window for saving the fault list

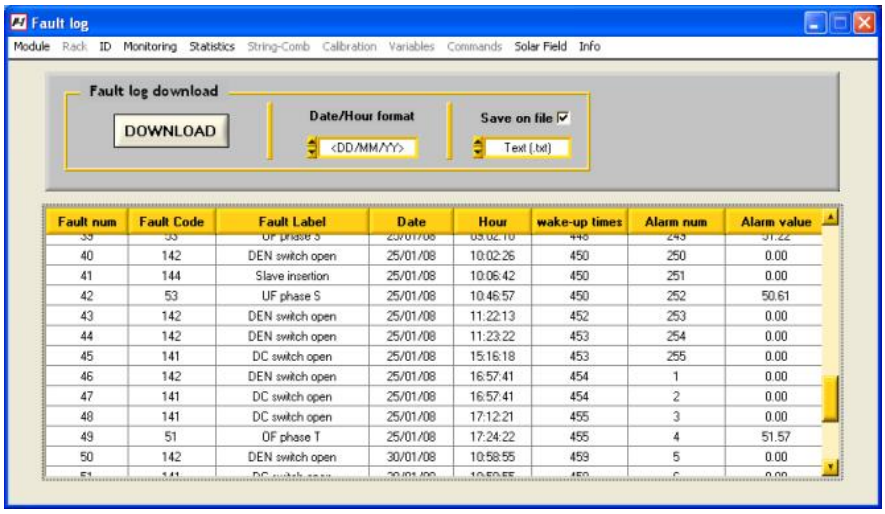


Figure 16-15: Populated Fault log

An example of a populated Fault Log is shown in Figure 16-15, where the following information is provided:

- **Fault num**: Progressive line number.
- **Fault code**: Code assigned to the fault.
- **Fault label**: Label describing the fault.
- **Date/hour**: Date and time when the fault occurred.
- **Wake-up times**: Progressive number of power start-ups.
- **Alarm num**: Progressive number indicating the number of alarms.
- **Alarm value**: Value of the dimensions which generated the fault.

16.4.9 Statistic Field Reset

The screen of Figure 16-16allows cancellation of all stored energy statistics values.

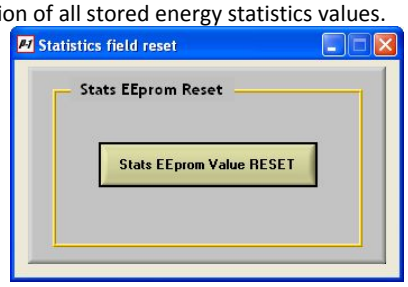
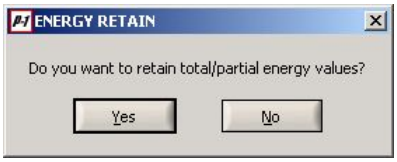


Figure 16-16: EEprom Reset

In Figure 16-16,, clicking on the [**Stats EEprom Value RESET**] button will result in the following warning window appearing:

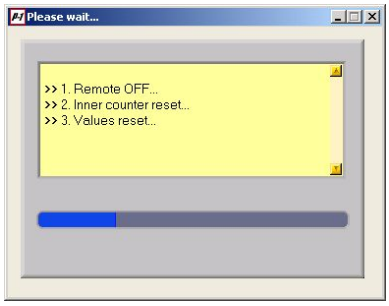
Pressing the [**OK**] button in the above screen will open warning screen shown below, which indicates this procedure will zero

all the stored energy statistics and prompts as to whether the user wishes to continue or keep the existing total and partial energy values:



Confirmation of the reset operation is again prompted in the screen below. Choose [**YES**] or [**NO**]:

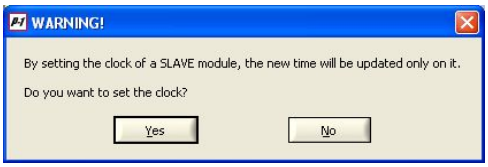
If the [**YES**] response is chosen, a processing window will open (below) which will perform the requested reset operations:



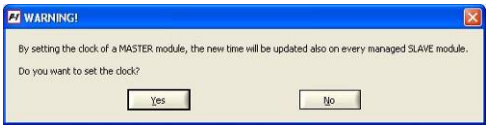
16.4.10 Inverter clock settings

The screen of Figure 16-17 allows user to set the system clock.

If the time is changed on a Slave module, the system warns the requested modification will only affect the chosen slave module.



If the time is changed on a Master module, the system warns the requested modification will also affect all the Slaves connected to chosen Master.



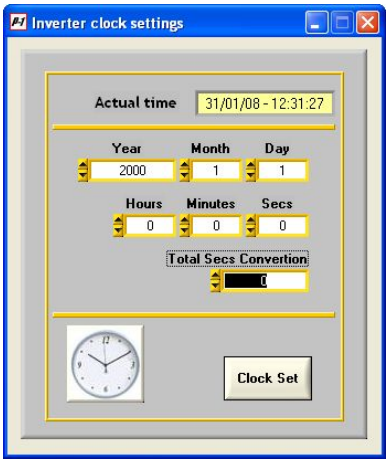


Figure 16-17: Inverter clock settings

The screen of Figure 16-16 shows the current system date and time; to change them, fill the field with the new data and press [**Clock set**].

16.4.11 String Comb monitoring

If the system has associated Aurora string combiner boxes (StringComb), the screen of Figure 16-18, allows the parameters of this apparatus to be monitored.

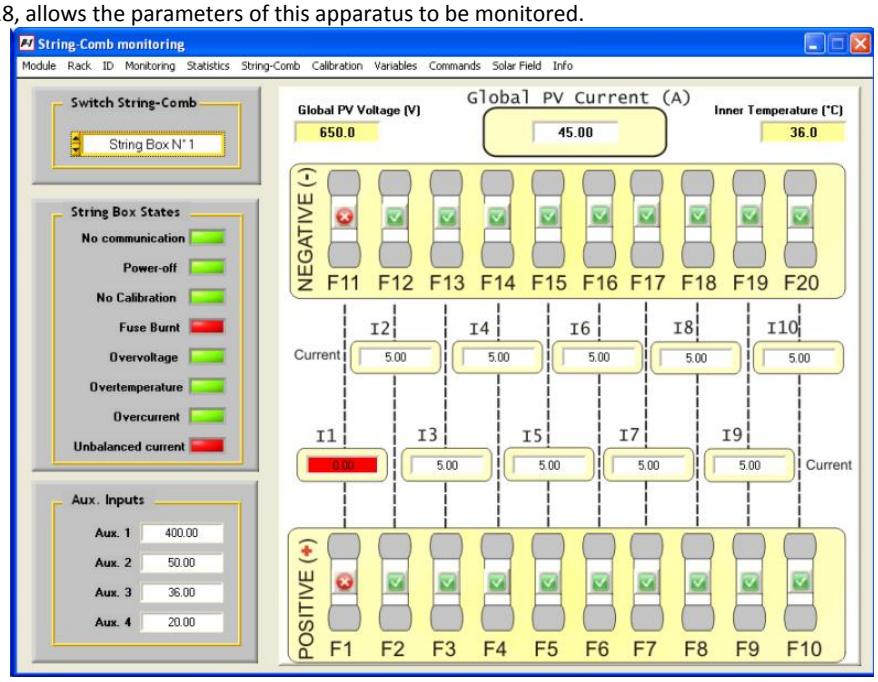


Figure 16-18: StringComb monitoring

To use this program, please consult the manual for the Aurora PVI-STRINGCOMB-US: "**BOXES FOR THE STRING CONNECTION FOR PHOTOVOLTAIC APPLICATIONS**" supplied with the string boxes, and available on the Power-One website.

16.4.12 Solar field scan

This function allows scanning of the connected PV field and graphs the power vs. voltage curve of the field.

The screen of Figure 16-19 is initially composed of blank area where the features detected in the field will be graphed:

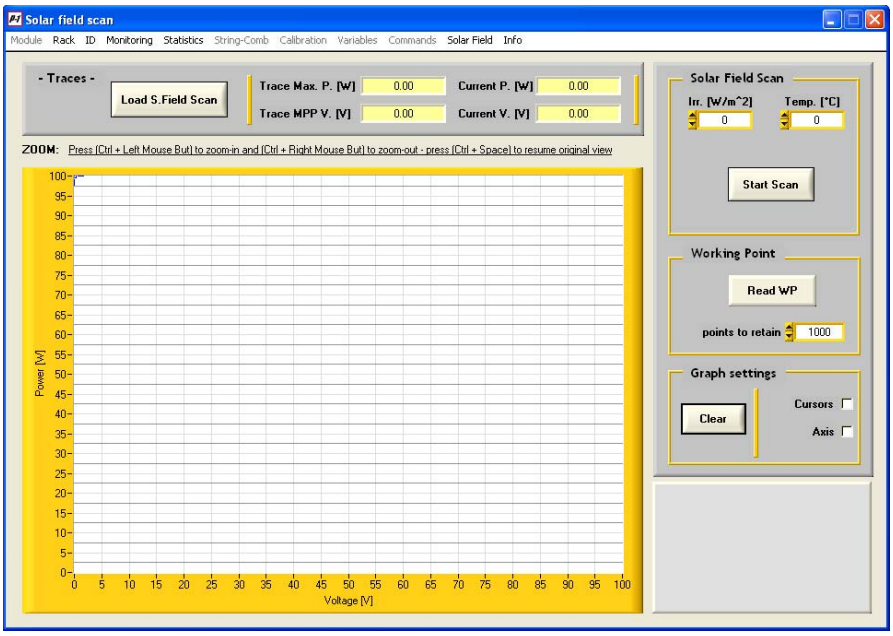


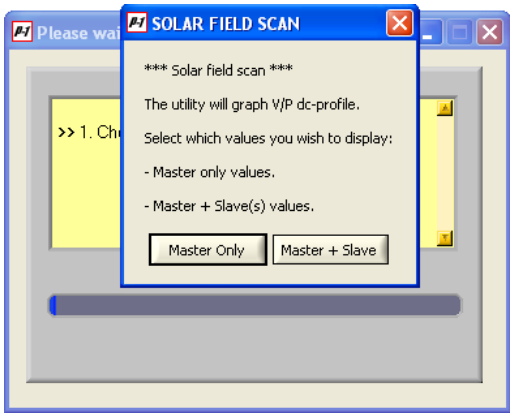
Figure 16-19: Unpopulated Solar Field scan screen

There are various areas on this screen with the following functions:

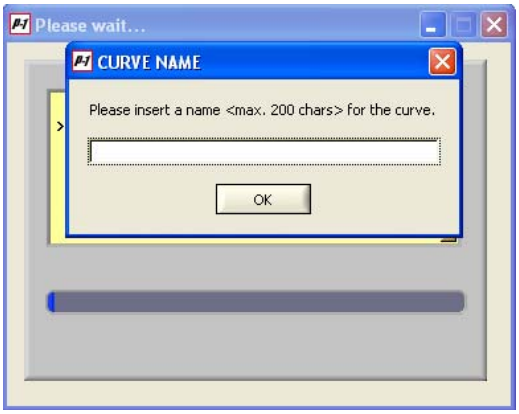
- **Solar Field Scan**: in this area, the environmental conditions associated with the scan can be noted for the P-V characteristic displayed. Pressing the [**Start Scan**] button will start the scan.
- **Working Point**: the [**Read WP**] button allows display of the maximum power working point and how many data points are to be shown in the graph.
- **Graph settings**: this allows for the display of a classic cross cursor and the projection of the point on its axes.
- The [**Clear**] button completely cancels the graphic.

Prior to starting scan, if known, the irradiance and temperature values associated with the graph can be entered in the fields shown. (operation is optional).

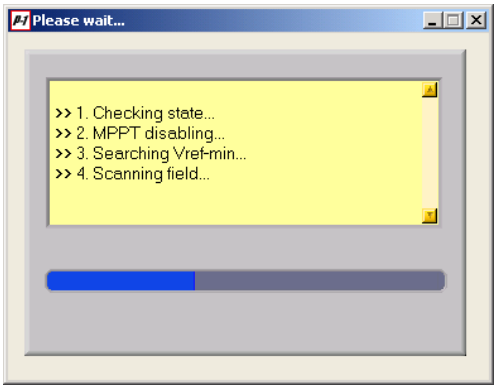
- Press the [**Start Scan**] button. The program then prompts whether the user wishes to display:
- Only the master curve (press [**Master Only**] button)
- Master with slaves (press the[**Master + Slave**]button)



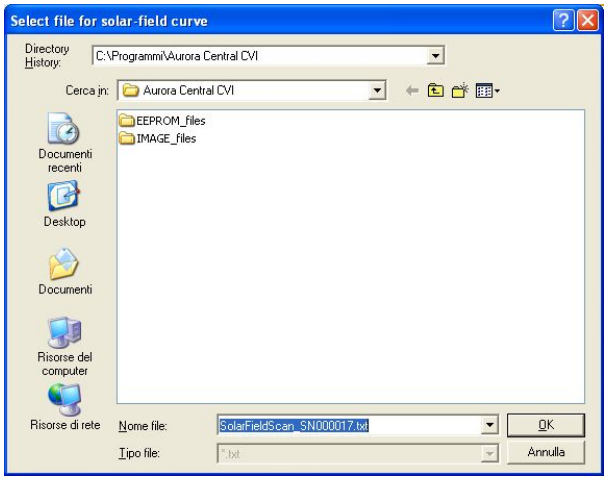
- After the above choice has been made, the system requests a name for the curve.



- After the confirmation [**OK**] the inverter will start the field scan.



- After completion of the scan, the program prompts for a name to be assigned to the data file.



- Enter a file name and press the [**OK**] button. After the file has been saved, the curve is drawn as shown in Figure 16-20.

:

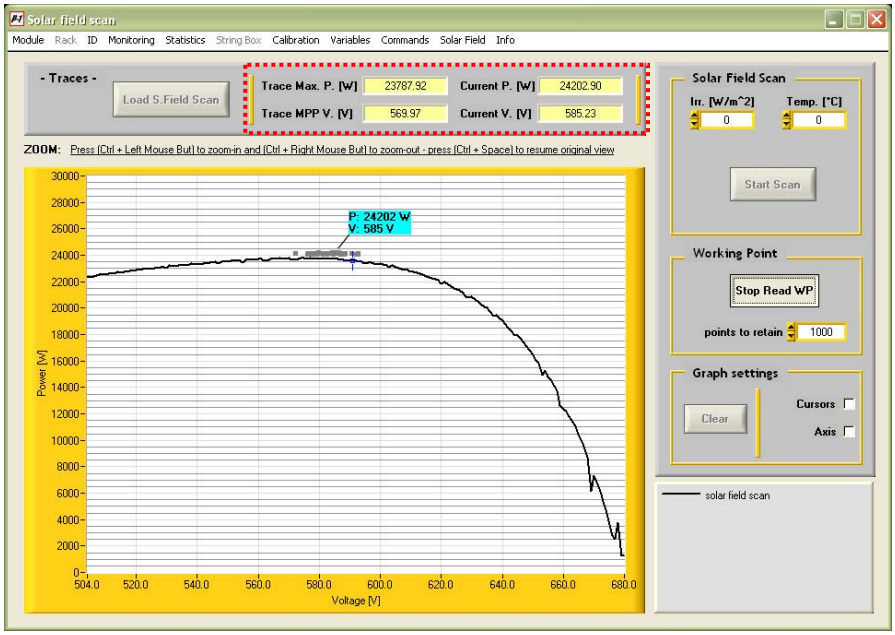


Figure 16-20: Polulated Solar Field Scan screen

In the area within the dotted line at the top of this screen, the values of exported power and voltage are displayed, as well as the maximum points reached by the curve.

Pressing the [**Read WP**] button allows display of the working point as indicated in the example of Figure 16-20.

16.4.12.1 Loading and displaying saved Power-Voltage curves

This function allows the P-V characteristics which have been previously stored to be recalled and compared, and the resulting composite file to be saved. In this way, an archive of the characteristics of the photovoltaic field can be created. This function is useful in the installation and maintenance phase. Refer to Figure 16-21:

- By pressing the [**Load S. Field Scan**] button a previously saved curve can be called and saved in the Selected Files field of the screen below:
- Select the file that contains the desired curve and click the [**Add**] button, to add the file to the Selected files field. Several curves may be displayed on the same graph, by similarly selecting them and clicking on [**Add**].
- In case of error, a selected curve can be removed by pressing the [**Remove**] button. By clicking the [**Remove All**] button, all curves are cleared from the Selected Files field.

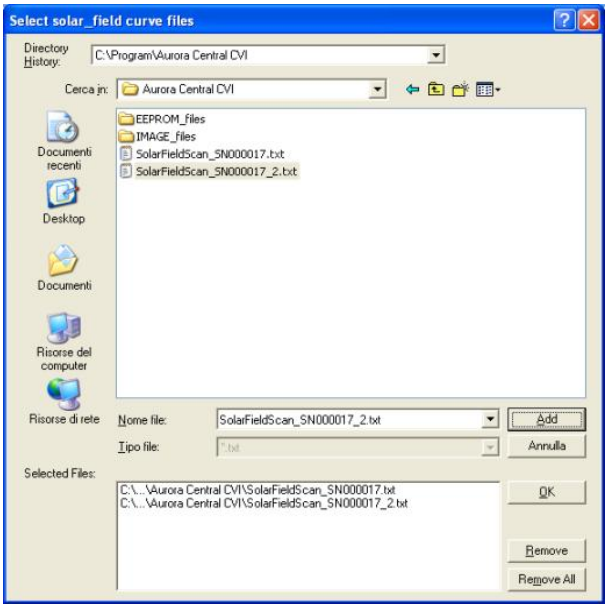


Figure 16-21: Solar scan graphing screen

16.4.12.2 Software Version

The screen of Figure 16-22, shows the version of the software is being used by the system.

Press the button to close the screen and return to the previous screen.

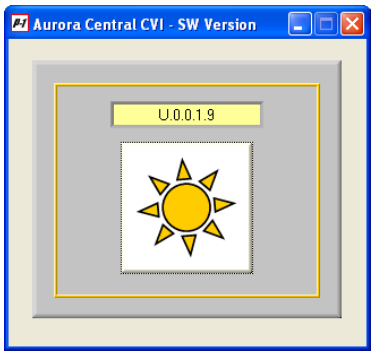


Figure 16-22 Software version

17. MAINTENANCE / REPAIRS

This chapter describes the operations necessary to disconnect the device in order to carry out internal repairs in safety conditions.
The type of disconnection depends on the action to be carried out. If the product is to be removed from service, it must first be completely disconnected from the DC and AC cables.

Chapter §20

To maintain the efficiency of AURORA PVI-NEMA3R-XXX-US(-TL) and guarantee safe operating conditions, the maintenance operations described in this section are necessary. Maintenance also includes checking wearable items, and if necessary replacing such components.

The equipment is designed to provide a lifetime operation of not less than five years, in the environment and for the type of application specified. Unscheduled maintenance interventions are not generally predictable and are due to verify the installation and to replace faulty components.

The routine or unscheduled maintenance activities should be performed whenever possible during periods of lower production efficiency, in order to reduce costs.

DANGER

Since most maintenance requires removal of the security panels, it is vital to insure before re-powering the inverter all covers and ground jumpers have been correctly replaced, with particular care given to the front access panels for the fuses and the relative earth connections.

17.1. Routine maintenance

Maintenance inside the PVI-NEMA3R-XXX-US(-TL) must be carried out following the procedures shown in Table 17-1.

Table 17-1: TABLE OF ROUTINE MAINTENANCE

ACTIVITY	FREQUENCY*	PAR.
Cleaning of filters and grills and internal inspection for dirt and/or water	Every Six Months	§17.1.1
Tightening screws and check on color changes	Annually	§17.1.2
Checks of the AC BOX area	Annually	§17.1.3
Checks of the transformer ACBOX area	Annually	§17.1.3
Checks of Framework area	Annually	§17.1.4
Check of warning cards and signaling devices	Annually	§17.1.5

The frequency of maintenance operations could be increased depending upon the environmental conditions of the install location.

17.1.1 Filter cleaning

To access the filter elements it is necessary to remove cover panels as noted in red, per Figure 17-1. Use the occasion to make a general visual inspection of PVI-NEMA3R-XXX-US(-TL).

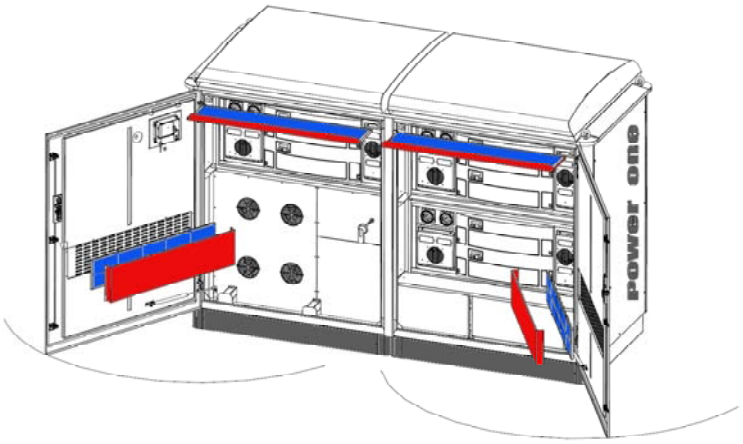


Figure 17-1: Position of the air filter panels

NOTICE

After filter elements are cleaned, insure they are completely dry- prior to re-assembly into the inverter.

17.1.1.1 Upper input air filters

To access the upper air inlet filters, first remove the cover panel at the top front of the inverter chassis (see Figure 17-2) by unscrewing the locking screws at each end. Then remove the filter frame by pulling it outward (Figure 17-2).

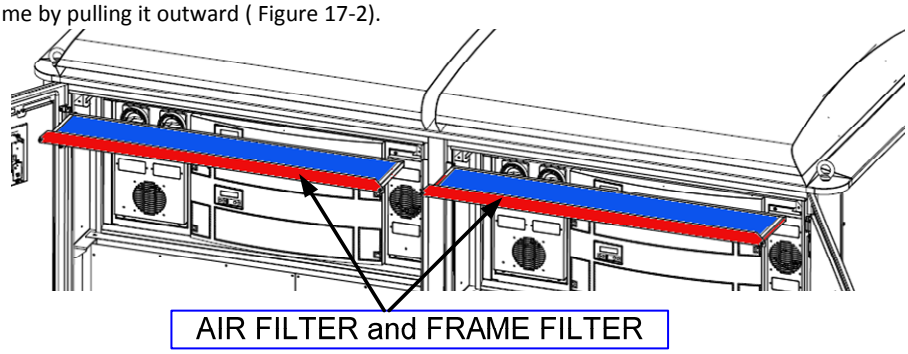


Figure 17-2: Upper filter panel

Remove the frame and then remove the filter fitted inside. Wash filter element in soap and water, rinse and dry completely; do not use flammable solvents! Before reinstalling the filter frame, check the air inlet grills for any obstructions.

After completion of the above procedure, reinstall the filter in the frame and reinstall in the slot in the inverter chassis. Replace the cover panel and tighten locking screws.

17.1.1.2 Door mounted air input filters

To access the door mounted air inlet filters, first remove the cover panel on the back of each inverter door by unscrewing the hold down screws. Then remove the frame that houses the filter itself (Figure 17-1 and Figure 17-3).

Once the filter frame has been removed, remove the filter element and wash in soap and water. Do not use flammable solvents!). Check the input grills and intervene in case of obstruction.

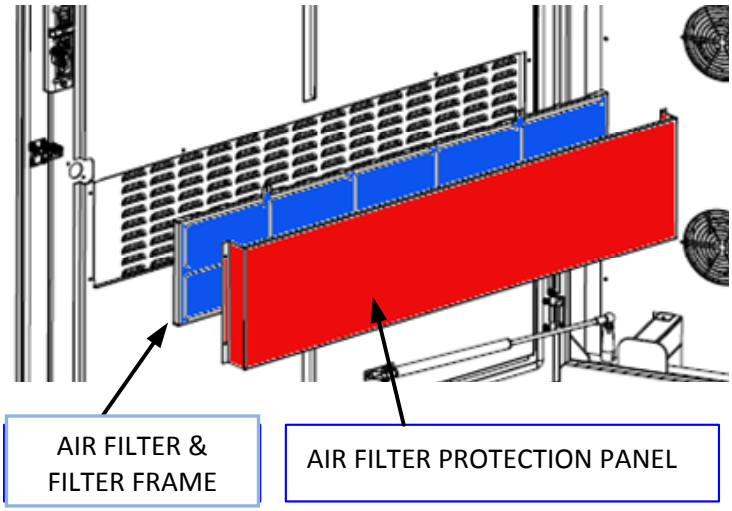


Figure 17-3 Frontal filter panel

17.1.2 Visual and Bus bar inspections

In order to check the bus bar connection integrity it is necessary to open the inverter. Make sure the entire system is switched off and isolated from the DC input as well as from the AC side.

DANGER: MANDATORY UPSTREAM DISCONNECTION

If it is necessary to operate on exposed parts (not protected by panels), it is not sufficient to turn the grid switches (AC) and field switches (DC) to 0 (OFF), because the input cables are always energized! Turn off and disconnect the inverter via external switches

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Once the system has been disconnected and the inverter panels have been removed Figure 10-7 and Figure 17-4, check as indicated in Table 17-2.

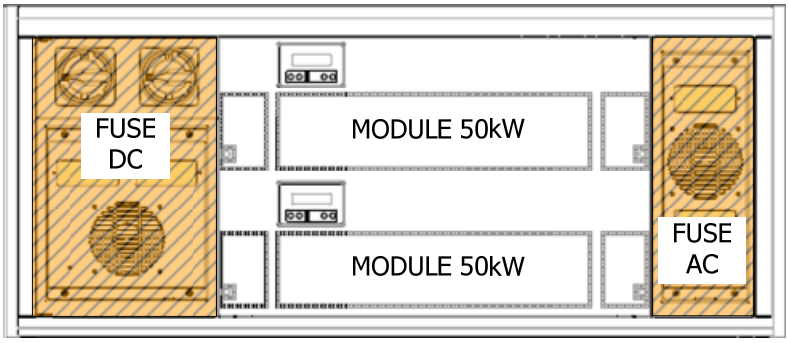

Figure 17-4: Framework cover panels to access DC and AC Fuses.

Table 17-2: TABLE OF VISUAL AND SCREW CHECKS

To be checked and/or tightened	Check point
AC fuse box	Connection points; visible by removing the AC panel of Figure 17-4
DC fuse box	Connection points; visible by removing the DC panel of Figure 17-4
AC input bars	Connection points; refer to Figure 5-8 and Figure 5-9
DC input bars	Connection points; refer to Figure 5-7
DC switches	Connection points; visible by removing the DC panel of Figure 17-4

To remove the panels it may be necessary to disconnect the wire of the protective earth wiring connections.
Remember to reconnect this wiring before reclosing every single panel!
The internal inspection of the modules can only be carried out by a specialist, suitably trained technician.

The visual inspection also includes checking any points where there is an evident change in color compared to other similar points. It is important to verify there is no change in color over time at the anchorage points, around the screws and in the insulation. Any non-uniform anomalous coloring is indicative of thermal stress condition and may lead possible mal-functioning of the inverter. In such case, contact your dealer who will assess whether a replacement is needed.
Also check for any corroded spots.
When checks have been completed, replace the panels and the associated earth connections correctly.

17.1.3 Checks of the ACBOX area

The following checks are related to the cooling system and the protection devices positioned in the ACBOX area, and it is therefore necessary to remove the front panel (G and H) indicated in Figure 10-7.

Chapter §10.2.4

DANGER

Before removing any safety panels, carry out the operations to switch off the inverter. DISCONNECT the AC voltage and wait at least 5 minutes before removing!

Replace the panel after the checks have been completed.

17.1.3.1 GFD fuse check

A lit LED indicator on any of the GFDs (per Figure 17-5) signals the presence of a ground fault and the fuse in the adjacent holder must be replaced.

Open the fuse compartment and remove the tripped fuse. Replace it with an equivalent fuse.

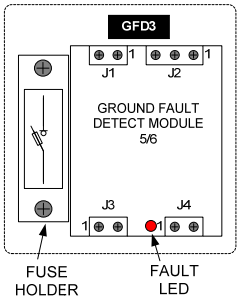

Figure 17-5: GFD and fuse holder

If the replaced fuse trips again, it will be necessary to check the system to locate the ground fault.

17.1.3.2 Fan control[1]

The 50kWp module fans are monitored automatically when the inverter is functioning, and therefore they do not need to be checked for operation

To check for the correct functioning of the fans in the ACBOX area and Framework area, carry out the following procedure:

- Note the present setting of the thermostats shown in Figure 17-6 and Figure 17-7. to allow subsequent reset after the following procedure (the normal setting is approximately 40°C)
- Insure the CB switch QS2 is ON
- Turn the thermostat temperature control knob completely counter-clockwise
- With the knob at this setting the thermostat the fans will be activated
- Make sure all are moving regularly and do not produce unusual noises.
- Turn the thermostat back to the originally noted value.

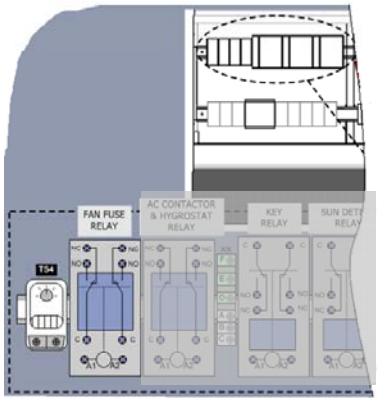

Figure 17-6: Thermostat for Framework fan

1 Also valid for ACBOX Transformer

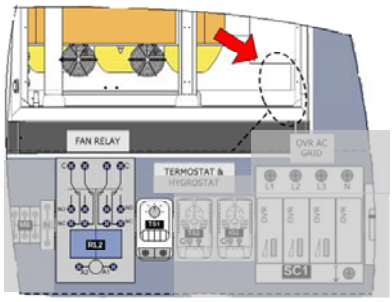

Figure 17-7: Thermostat for Transformer Fan

17.1.3.3 Check of the power switch operation

To check operation:

- Use a screwdriver to press the button with the word TEST on the disconnecting switch (Figure 10-9 – (4)). Make sure that the knob turns clockwise from the ON ("1") position to the yellow OFF ("0") position
- Before replacing the panel, insure the switch is in the "0" position, and the switch handle mounted on the cover is properly aligned.

17.1.3.4 OVR AC device check.

Refer to Figure 17-8 and Figure 17-9), and check that the inspection windows are not red in color. If so, replace the faulty cartridges with others of the same type

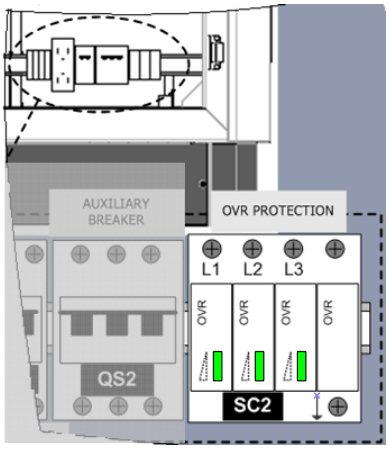

Figure 17-8: OVR Auxiliary VAC Devices

It is necessary to check the fuses in the fuse boxes (F1) of Figure 17-9.

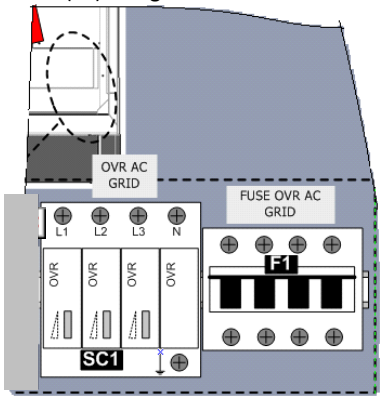

Figure 17-9: OVR VAC Grid

17.1.4 Checks on the Framework

17.1.4.1 OVR DC device check.

The integrity check of the DC OVR device is performed automatically and the LED display will signal a fault condition accordingly. If a fault is indicated the open fuse cartridge must be replaced. Good practice dictates checking all other fuses as well.

The DC-side OVR fuse block is located within the framework chassis and requires removal of the associated 50 kW module to gain access.

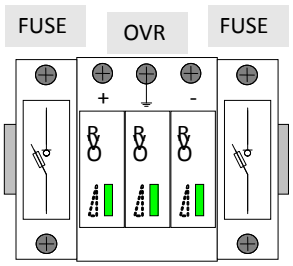

Figure 17-10: OVR DC Devices

17.1.4.2 Check of the AC fuses

Inspection of the AC line fuses can be completed visually as they may be viewed through the appropriate inspection window on the associated framework; see Figure 17-4. As such, it isn't necessary to open the AC panel or switch off the inverter.
The state of the fuse is signaled by a small lever above each fuse: when the fuse is intact, the lever is horizontal and attached to the fuse box; if the fuse is blown, the lever will move to a vertical position.

17.1.4.3 Check of the DC fuses

If the inverter fails to detect sunlight and always indicate that there is no sun, a likely reason could be a blown DC fuse.

To inspect the DC fuses, it is not necessary to open the AC panel and switch off the inverter as the fuses can be checked visually through the associated framework window (per Figure 17-4).

17.1.5 Check of warning labels and signaling devices

Check that all labels bearing warnings or indications are intact and well bonded to the chassis of the inverter. In particular, the danger labels should always be clearly visible. If necessary, contact Power-One.

17.2. Replacement of faulty battery

NOTICE

This component must be replaced only by a qualified technician.

Each 50kWp module provisioned in the inverter has installed a CR203 type2 Lithium buffer battery, which functions to keep the internal clock powered for statistical calculations.

If the battery fails, the system will still function, however, energy data will not be correctly recorded until the battery is replaced.

To access the battery, the module of concern must be withdrawn from its seat.
If the LCD displays a "Battery Fail" fault, contact your dealer for maintenance.

19. SWITCHING OFF AND DISCONNECTING THE SYSTEM

DANGER

When it is necessary to maintain exposed normally energized parts, it is not sufficient to turn the grid switch (AC) and DC PV field switches to OFF (“0”) position, because the input cables are always under voltage!
Turn off and disconnect the inverter.

Chapter §19

MANDATORY UPSTREAM DISCONNECTION

19.1. Disconnection from the AC grid

The procedure for disconnecting AURORA from the grid is the following:

1. It is advisable to set all Master modules of the rack on the REMOTE OFF position by means of the display.

   In this way, the power fed into the grid is practically zero and the AC switch can be opened in the absence of any load.
2. Turn the AC switch to the OFF (0) position, i.e. turn it counter-clockwise:
   a. The inverter disconnects from the AC grid and therefore it no longer supplies power.
   b. All the displays of the rack relative to the open switch will signal an AC switch alarm.
   c. The LED flashes. POWER ON
   d. The ALARM LED is on.
   e. The MISSING GRID LED is on.

   In this phase, it is possible that the modules display a different error in the first minute, since the opening of the grid switch is interrupted and a Grid Fault alarm or similar may be triggered off. After the recovery time (e.g. 60 sec), the signal will be the same on all modules.

19.2. Disconnecting the photovoltaic field

Below, the procedure for disconnecting AURORA module 50kW from the photovoltaic field (DC):
Make sure that the AC switch is in 0 position.

Chapter §1.1

Open the door.
One at a time, turn the DC switches to the 0 position (Figure 6-4 (A)), i.e. turn them counter-clockwise:

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In the case of Multi-Master/Slave (250/300kW US), both switches of a framework must be turned so that the modules are physically disconnected from the field (Table 6-1,).

In the case of 1Master/N.Slave (350/400kW US TL), all switches of a rack must be turned so that the modules are physically disconnected from the field (Table 6-2). Disconnection is also possible from the external DC switch.

WARNING

Before proceeding to the next step, wait 30 minutes to allow system components to cool by allowing proper heat dissipation through the system fans.

19.3. Disconnection from the auxiliary source

To perform this operation check first for a local disconnect switch located (by the installer) upstream of the inverter, or use the internal QS2 switch, according to the following steps:
Follow the directions regarding the disconnection of the AC and DC, and then go to next step.

Chapter §1.1
Chapter §19.2

Set the QS2 switch to OFF to disconnect the auxiliary supply (Figure 11-5).

At this point, the system is completely disconnected and switched off.

19.4. Upstream disconnection of the inverter

If it is necessary to move/remove the PVI-NEMA3R-XXX-US(-TL), or to completely isolate it from the rest of the plant, it is absolutely mandatory to disconnect the device from both the DC and AC sides, i.e. from the photovoltaic field and from the grid. To do this, it is necessary to disconnect the DC input voltage and the output distribution lines connected to the AC clamps, and the 3P+N auxiliary power.
This operation is only possible by using the switches on the photovoltaic field and on the distribution line, and not the switches on board the inverter.
At this point, if necessary, the DC and AC cables can be physically disconnected from the inverter, removing the necessary paneling.
Chapter §10.2.4, Chapter §1.1
Chapter §19.2, Chapter §19.3

19.5. Removal and insertion of a 50kWp module

For some types of extraordinary intervention it may be necessary to remove a 50kWp module from its seat (for example, in case of module breakdown).

19.5.1 Preliminary operations

A module is too heavy to be supported by a person; therefore it is necessary to use a mechanical aid to facilitate the withdrawal operation and the further insertion (see the figures below as an example).

Follow the directions regarding the disconnection of the AC and DC, and then go to next step.

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Locate the module to be removed and remove the 4 screws securing 50kWp module to the framework.

19.5.2 Removing the module

After having completed the previous paragraph, follow the indications:
Place the lifting trolley with the platform or prongs in line with the base of the module to be removed.

NOTICE

DO NOT JERK OR OTHERWISE ABRUPTLY MOVE THE MODULE!

Pull the module approx. 15cm from the framework and place the lifting trolley with the platform or prongs under the base of the module to be withdrawn.
Finish withdrawing the module completely from the seat.

19.5.3 Insertion of the module

Align the platform on which the module to be inserted is positioned, with the supporting brackets of the framework.
Push the module into the framework, leaving off approx. 15cm.

NOTICE

DO NOT PUSH ON OR OTHERWISE APPLY PRESSURE TO THE FAN GRILLS!

Remove the trolley and push the 50kWp module firmly so that it enters the framework.
Insert the 4 blocking screws of the 50kWp module.

19.5.4 Final operations

After having completed the previous paragraph, follow the indications:
Perform the commissioning again following the relative instructions.

Chapter §12

20. SCRAPPING

When the PVI-NEMA3R-XXX-US(-TL) must be scrapped, it must be completely disconnected.

Chapter §19

Take the PVI-NEMA3R-XXX-US(-TL) to an authorized collection point.

Chapter §1.1

21. TROUBLESHOOTING

21.1. FAQ (Frequently Asked Question)

Before the product is dispatched, various tests are carried out successfully, in order to check: the functioning, the protection devices, the performances.
Such tests, together with the Power-One quality assurance system, guarantee optimal operation of AURORA.
If a problem arises, the following events occur on one or all of the modules:

The red LED "*ALARM*" is always on (ON)
The green LED "*POWER ON*" flashes
The module concerned, or all the modules, disconnect from the grid.

In the case of breakdown, the system waits 60 seconds (standard value), then cancels the fault signal and attempts to reconnect to the distribution grid.
If, after this time, the system continues to signal an error, deal with the problem according to the following instructions.
Follow the indications in the following table if the problem detected coincides with one of the cases described.
If there are no doubts, and if none of the solutions is of help, you must contact your dealer.

Table 21-1: **Troubleshooting**

PROBLEM (FAQ)	POSSIBLE CAUSE	SOLUTION
Software		
The serial communication of one or more Modules does not work	a) Interrupted line b) Wrong termination c) Repeated addresses d) Faulty card	Make sure that: a) There are no interruptions of the line b) The termination must be enabled only on the last one of the chain Chapter §8, Chapter §11.7.2 c) There should not be similar addresses in the whole chain Chapter §11.7.4 d) Contact the dealer
The communication seems to be working but all the modules are not "visible" from the scanning program.	The configuration baud rate of the Modules is different from that of the adapters.	Use the default 9600 baud-rate configuration.

PROBLEM (FAQ)	POSSIBLE CAUSE	SOLUTION
Signaling on the Display		
Faulty (SPD / OVR) Discharger	The SPD has intervened (for overvoltage) and must be replaced.	Replace the damaged cartridge/s Chapter §17.1.4.1
The LED "*Missing Grid*" is on	a) Grid switch open b) An anomaly was detected on the distribution grid	a) Make sure that the grid switch is in ON position b) Make sure there are no electrical grid problems due to the manager (in this case wait for recovery)
The display signals "*Waiting remote on*"	a) The "Software ON/OFF" control was enabled from the display b) The "Remote ON/OFF" signal was opened on the terminal block	a) Cancel the SOFTWARE ON/OFF command by setting it on "Not Active" (Figure 13-3) b) Close the signal.

PROBLEM	POSSIBLE CAUSE	SOLUTION
The display signals "*Waiting for sun*"	The photovoltaic system does not provide enough power to connect the inverter (e.g. cloudy sky)	Wait until environmental conditions are favorable
The inverter indicates a fault on one of the String-Comb.	One or more parameters controlled by the string box is/are over the limit	Verify that the information in the PVI-STRINGCOMB manual covers this series. If necessary contact the dealer.
The inverter does not receive DC voltage from the panels and remains in Energy save (SE)	a) DC switch is open. b) Interruption in the DC line c) The field voltage is insufficient	a) Close the DC switch placed on the front of the inverter. b) Are the DC cables connected? Is there an open switch upstream? c) check the DC voltage of the field.

21.2. Before contacting the dealer (Questionnaire)

In case of problems which cannot be solved directly, and in any event whenever it is necessary to contact the dealer, we advise you to make a note of the following information:

21.2.1 Problems on the StringCombs

INFORMATION ON STRINGCOMBS

- Type of problem.
- Number of PVI-STRINGCOMB-US in the system.
- Number of PVI-STRINGCOMB-US involved in the problem.
- Where are they installed? (ground, roof, etc.)
- Has the last PVI-STRINGCOMB-US of the series chain been terminated?
- How many strings enter the PVI-STRINGCOMB-US?
- Composition of a string:
- Number of panels in a series.
- Type of panels (Producer and Model).
- Other information (e.g. Are there any diodes?
- Is the photovoltaic field insulated from ground?

21.2.2 Problems on the PVI-NEMA3R-XXX-US(-TL)

INFORMATION ON THE INVERTER

- Information available directly from the LCD display
- AURORA model ?
- Serial number ?
- Week of production ?
- What is the state of each LED ? (flashing, or ON or OFF?)
- What signals can be viewed on the display?
- Brief description of the fault.
- Have you noticed if the fault is due to any specific operation ?
- If so, which ?
- Have you noticed if the fault is cyclical ?
- If so, how often ?
- Was the fault apparent at the moment of installation ?
- Describe the atmospheric conditions at the time of occurrence of the fault.

INFORMATION on the Photovoltaic Field

- Make and model of photovoltaic panels
- Plant structure:
  - maximum array voltage and current values
  - number of array strings
  - number of panels for each string

22. ERROR MESSAGES AND CODES

The state of the system is indicated by a warning sign (Warning) or an error sign (Error) displayed on the LCD display.
The Table 22-1 which follows briefly describes the two types of signals that may appear.

22.1. Warning

These indicate the state of AURORA, therefore they are not caused by a fault and do not imply the need for any action (lack of grid, sun, etc.). These will cease to be displayed as soon as normal conditions will be restored. Warnings are indicated in the table below by a “W”.

22.2. Error

Indicate a possible fault of the apparatus or of the elements connected to it. Also in this case, the signal will disappear as soon as the causes are identified.

The occurrence of an error signal generally implies an intervention that is maintained by Aurora as much as possible, or it will provide appropriate indications in order to assist the person working on the device or plant, to perform the necessary maintenance. Errors are indicated in the table below by an “E”.

After the connection, if the inverter receives incorrect information during the test cycle, the system will interrupt such cycle and will signal the warning or error code.
The system will continue to repeat the display of the error message until the error has been removed.

Once the error has been removed, the inverter resets all functions in progress and automatically restarts the connection.

Chapter §12.1

Table 22-1: Table of Error Messages and Codes

Message	W (warning)	E (error)	Description
OC Panel		E001	Current input above maximum threshold
Bulk OV		E004	Voltage across capacitors above maximum threshold
Communication		E005	Error in communication with the DSP
OC		E006	Exit current above maximum threshold
OCH		E007	IGBT current above maximum threshold or IGBT sat.
Over Temp		E014	Overheating (detail visible from software)

Message	W (warning)	E (error)	Description
Delta Bulk		E015	Difference in voltage of DC condensers above maximum threshold
Grid OV	W004		OV mains network voltage
Grid UV	W005		UV mains network voltage
Grid OF	W006		OF mains network
Grid UF	W007		UF mains network
Forbidden State		E024	Non-admitted state
Fan Fail	W010		Left fan blocked
UTH		E033	Temperature below minimum threshold (detail visible from software)
Remote OFF		E035	Remote Off
Pneg	W014		Zero power exported
Grid df/dt	W015		df/dt network
DEN Switch Open SPD Switch Open	W016		Surge Protector Device (SPD) failure (cartridge to be replaced)
UC Panel		E037	Negative input current above maximum threshold
FAN Stuck		E038	Central or right fan is blocked
DC Switch Open		E039	DC disconnecting switch open
JboxFail	W017		One or more StringCombs have communicated a problem
TRAS Switch Open		E040	AC disconnection switch open
Relay AC		E041	Internal AC contactor has not switched over
Bulk UV		E042	Voltage of capacitors below minimum threshold
Auto exclusion		E043	Self-exclusion of module due to repeated faults
RISO		E025	Isolation resistance below minimum threshold

23. TECHNICAL DATA

23.1. Technical data tables

The following tables show the characteristics of the PVI-NEMA3R-XXX-US(-TL).

Table 23-1: Data Sheet PVI-NEMA3R-250/300-US

Characteristics	PVI-NEMA3R-250-US	PVI-NEMA3R-300-US
Input Parameters		
Maximum recommended PV power (KWp)	275	330
Absolute maximum input voltage (Vdc)	600	600
MPPT input voltage range Vdc	320 - 600	320 - 600
Number of MPPT (Master/ Slave)	3	3
Total Maximum input current (Adc) For module	850 170	1020 170
Input Reflected Ripple voltage	<3%	< 3%
Number of DC inputs available	5	6
Input overvoltage protections	5 (1 for each input)	6 (1 for each input)
Output Parameters		
Nominal AC Output Power (KWp)	250,00 @40°C ambient	300,00 @40°C ambient
Nominal AC Output Current (Arms)	315 (for each phase)	378 (for each phase)
AC Output Voltage range (Vrms)	480V Δ (423Vac – 528Vac)	480V Δ (423Vac – 528Vac)
Nominal AC Frequency (Hz)	60 (59.3 – 60.5)	60 (59.3 – 60.5)
Power Factor (cos ϕ)	>0.99 (@ Pac nominal)	>0.99 (@ Pac nominal)
AC Current Harmonics (THD%)	< 4% (@ Pac nominal)	< 4% (@ Pac nominal)
Inverter Switching Frequency (KHz)	9	9
AC side overvoltage protection	Yes	Yes
Conversion Efficiency		
Peak Efficiency % (@ Vin 330)	T.B.D	T.B.D
CEC Efficiency %	T.B.D	T.B.D
Environmental Parameters		
Environmental Protection Degree	Nema3R	Nema3R
Operating Temperature Range	-25°C...+60°C (with Pout derating)	-25°C...+60°C (with Pout derating)
Storage Temperature	-25°C...+60°C	-25°C...+60°C
Relative Humidity (non-condensing)	< 95%	< 95%
General Data		
Auxiliary Voltages Consumption (W)	T.B.D	T.B.D
Night time losses (W)	T.B.D	T.B.D

Local Communication	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB-US)	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB-US)
Remote Communication (optional)	T.B.D	T.B.D
User Interface	Touch screen display	Touch screen display
Mechanical Characteristics		
DC CONNECTIONS (max wire / cable lug)	10 x 350 Kcmil 90° / M10	12 x 350 Kcmil 90° / M10
AC CONNECTIONS (max wire / cable lug)	3 x 350 Kcmil 90° / M10	3 x 350 Kcmil 90° / M10
PE CONNECTION (max wire / cable lug)	1 x 4/0AWG 90° / M12	1 x 4/0AWG 90° / M12
Dimensions (WxHxD) (mm)	2933 x 1947 x 1250	2933 x 1947 x 1250
Overall Weight (Kg)	T.B.D	T.B.D
50kW module Weight (kg)	70	70
Required Ambient Air Cooling Flow (m^3/h)	T.B.D	T.B.D

Table 23-2: Data Sheet PVI-NEMA3R-350/400-US-TL

Characteristics	PVI-NEMA3R-350-US	PVI-NEMA3R-400-US
Input Parameters		
Maximum recommended PV power (KWp)	385	440
Absolute maximum input voltage (Vdc)	600	600
MPPT input voltage range Vdc	320 - 600	320 - 600
Number of MPPT (Master/ Slave)	1	1
Total Maximum input current (Adc) For module	1190 170	1360 170
Input Reflected Ripple voltage	T.B.D.	T.B.D.
Number of DC inputs available	7	8
Input overvoltage protections	7 (1 for each input)	8 (1 for each input)
Output Parameters		
Nominal AC Output Power (KWp)	350,00	400,00
Nominal AC Output Current (Arms)	T.B.D.	T.B.D.
AC Output Voltage range (Vrms)	T.B.D.	T.B.D.
Nominal AC Frequency (Hz)	60	60
Power Factor (cos ϕ)	T.B.D.	T.B.D.
AC Current Harmonics (THD%)	T.B.D.	T.B.D.
Inverter Switching Frequency (KHz)	T.B.D.	T.B.D.
AC side overvoltage protection	Yes	Yes
Conversion Efficiency		
Peak Efficiency % (@ Vin 330)	T.B.D.	T.B.D.
CEC Efficiency %	T.B.D.	T.B.D.
Environmental Parameters		
Environmental Protection Degree	Nema3R	Nema3R
Operating Temperature Range	-25°C...+60°C (with Pout derating)	-25°C...+60°C (with Pout derating)
Storage Temperature	-25°C...+60°C	-25°C...+60°C
Relative Humidity (non-condensing)	< 95%	< 95%
General Data		
Auxiliary Voltages Consumption (W)	T.B.D.	T.B.D.
Night time losses (W)	T.B.D.	T.B.D.
Local Communication	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB-US)	1x RS485 + 1x RS485 (dedicated to PVI-STRINGCOMB-US)

Remote Communication (optional)	T.B.D	T.B.D
User Interface	Touch screen display	Touch screen display
Mechanical Characteristics		
DC CONNECTIONS (max wire / cable lug)	T.B.D	T.B.D
AC CONNECTIONS (max wire / cable lug)	T.B.D	T.B.D
PE CONNECTION (max wire / cable lug)	T.B.D	T.B.D
Dimensions (WxHxD) (mm)	T.B.D	T.B.D
Overall Weight (Kg)	T.B.D	T.B.D
50kW module Weight (kg)	70	70
Required Ambient Air Cooling Flow (m^3/h)	T.B.D	T.B.D

24. TIGHTENING TORQUE FOR CONNECTORS

The table below report the tightening torque for pressure wire connectors installed on the inverter.

Table 24-1 : Tightening torque for connectors

CONNECTORs	AWG range	Torque (N*m) range
AUXILIARY Connectors	12 ÷ 4	1.5 ÷ 1.8
AUXILIARY Connectors for Voltage selection	18 ÷ 12	0.5 ÷ 1
SIGNAL Connectors	20 ÷ 12	0.4 ÷ 0.6

25. ADJUSTABLE TRIP POINTS

The table below lists the adjustable trip points of the inverter (@208Vac).

Table 25-1 : Default values for voltage and frequency limits for utility interaction

	DEFAULT VALUES		Timeout
DISPLAY Variable	Grid Voltage (V)	Frequency (Hz)	sec
19 (read only)	106.08	-	0.16
45	183.04	-	-
46	-	-	2
43	228.8	-	-
44	-	-	1
17 (read only)	247.5	-	0.16
27 (read only)	-	60.5	0.16
26	-	59.3	0.16

Table 25-2 : Voltage and frequency limits for utility interaction adjustable trip points

	Adjustable Trip points		Timeout
DISPLAY Variable	Grid Voltage (V)	Frequency (Hz)	sec
19 (read only)	$V < 0.51\ V_{nor}$ [V < 106.08]	-	0.16
-	$0.51\ V_{nor} \leq V < Vuv$ [106.08 ≤ V < Vuv]	-	Tuv
45	Vuv is adjustable from $0.55\ V_{nor}$ to $0.88\ V_{nor}$ [114.4 to 183.04]	-	-
46	-	-	Tuv is adjustable from 2 to 5
-	$Vov < V < 1.19\ V_{nor}$ [Vov < V < 247.5]	-	Tov
43	Vov is adjustable from $1.10\ V_{nor}$ to $1.18\ V_{nor}$ [228.8 to 245.44]	-	-
44	-	-	Tov is adjustable from 1 to 5
17 (read only)	$1.19\ V_{nor} \leq V$ [247.5 ≤ V]	-	0.16
27 (read only)	-	f > 60.5	0.16
-	-	f < (Fmin)	0.16
26	-	Fmin is adjustable from 57 to 59.8	-

26. CERTIFICATE OF CONFORMITY

These items to be added